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PRELIMINARY TECHNICAL INFORMATION REPORT

Reserve at Green Mountain

City of Camas, Washington

Prepared by:

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Prepared: May 2025
Revised: August 2025

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CERTIFICATE OF ENGINEER

Reserve at Green Mountain

Technical Information Report

The technical information and data contained in this report was prepared under the direction and supervision of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

TRAVIS G. JOHNSON
43929

5-20-25

This document was prepared by:

Calvin Hillman-Johnson

Section A – Project Overview

Section A.1 – Site Information

This project will comply with current City of Camas Standards for Stormwater and Erosion Control per CMC Title 14. The Final Grading / Erosion Control / Drainage Plans have been prepared by the project civil engineer, PLS Engineering, Inc. The site will be served by public sewer and water provided by the City of Camas. This project phase proposes construction of 38 single-family residential lots with associated structures, access, paved storage areas, sewer, water, and storm drain connections. Access to the site is from NE 28th Street.

The physical address of the site is currently 21917 NE Goodwin Rd, but the Building Official may change that prior to the completion of this project. The parcel serial number is 173192000. The property is located in the southeast and southwest quarter of Section 21, T2N, R3E of the Willamette Meridian. The property is bordered by NE 28th Street on the north side, a 1-acre single family lot to the Northwest, a 3-acre residential lot to the West, a 13.39 residential lot to the Southwest, a 6 acre and 2-acre residential lot to the East, and Clark County Parks to the South. The cumulative property area contains a total of 509,117 square feet (11.69 acres), a basin area of 376,257 square feet (8.64 acres) with 83,630.21 square feet (1.19 acres) of right of way dedication, resulting in 292,627 square feet (6.72 acres) of developed area. This technical information report will address the stormwater runoff associated with the construction which will take place.

The topography of the site is moderately sloped from NE to SW, with elevations ranging from 232’ to no greater than 192’. Slopes are generally between 2% and 6%, with some isolated steeper slopes at the South end of the site at around 20%. The site slopes down from relative high point in the NE corner towards the SW property corner. The site contains a 3,016 square foot house, a 1,475 square foot concrete foundation, and a 1,148 square foot garage. The house will remain, and all other structures will be along with existing impervious surfaces on-site are planned to be removed. The remainder of the site is filled with grass, weeds, and a variety of trees. There are wetlands mapped on Clark County Maps at the SW corner of the site. There is a stream marked in the Southeast corner of the site. Otherwise, there are no known water courses, areas prone to flooding, floodplains, shoreline areas, water bodies, unstable slopes, landslide hazard areas, habitat, critical areas, or historic sites located on the site. Site drainage follows the slope of the land going from the NE corner to the SE corner. Site discharge will not exceed historic rates.

After construction, the site will contain approximately 109,745 square feet of landscaped area. The remainder of the site is anticipated to be covered with impervious surfaces. This will include 177,048 square feet of roof area, 14,415 square feet of sidewalk, and 41,865 square feet of concrete and asphalt for driveways and drive aisles. Site stormwater will be routed to a detention pond that will release the runoff at rates less than existing in accordance with the SWMMWW. Frontage stormwater will be routed to a bioretention facility for treatment and infiltration. Site stormwater runoff treatment for the site’s pollution generating impervious surfaces will be accomplished with media filter treatment cartridges located in stormwater structures throughout the site.

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Section B – Minimum Requirements

Section B.2 – Determination of Applicable Minimum Requirements

After site development, disturbed impervious surfaces will cover approximately 266,512 square feet, or 53% of the disturbed project area; projects resulting in more than 5,000 square foot of hard surface area must meet all nine Minimum Requirements of the stormwater manual. The entirety of the developed site will all discharge to the detention pond, acting as one TDA, and will all be required to meet Minimum Requirements #6 and #7. The stormwater system is designed to comply with all City requirements for stormwater treatment and quantity control. The treatment regulations require treatment of 91% of the total runoff volume from pollution generating impervious surfaces while the quantity control regulations require that post-development discharges shall match pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.

Existing hard surface	36,780 ft^2
New hard surface	266,512 ft^2
Replaced hard	33,764 ft^2
Native vegetation converted to lawn or landscaping	109,745 ft^2
Native vegetation converted to pasture	0 ft^2
Total land-disturbing activity	8.64 acre
Pollution-generating hard surface	89,464 ft^2
Pollution-generating pervious surface	0 ft^2
Total pollution-generating surfaces	89,464 ft^2
Total non-pollution-generating surfaces	286,793 ft^2

MR #1) Preparation of Stormwater Site Plans
All Stormwater System designs meet City of Camas Requirements for conveyance, quality control and quantity. See final construction documents for more details.

MR #2) Construction Stormwater Pollution Prevention
A Stormwater Pollution Prevention Plan is being included with this report and will be onsite for the duration of the project's construction.

MR #3) Source Control of Pollution
See Section D

MR #4) Preservation of Natural Drainage Systems and Outfalls
Site runoff flows to the SE corner of the site. The proposed development will capture the existing runoff and infiltrate some and releasing the rest at rates that are incompliance with the SWMMWW. This will maintain and preserve the natural drainage systems.

MR #5) Onsite Stormwater Management
See Section E

MR #6) Runoff Treatment
See Section F

MR #7) Flow Control
See Section G

MR #8) Wetland Protection
Clark County maps show a category II NWI wetland located in the SW corner of the site. See Appendix F for documentation discussing impact on the wetland and Sections H.

MR #9) Operations and Maintenance
See Appendix D

Section C – Soils Evaluation

The soils are mapped by the NRCS as McBee silt loam (MlA) in the Northeast corner of the site, Dollar loam (DoB), in the north, Cove silty clay (CvA) on the West edge and Southwest section, and Lauren gravelly loam (LrC) in under the existing house and Southwest corner. The geotechnical soil investigation found surface soils generally consistent with that soil mapping. The geotechnical report has been included in Appendix C and a soil map is included in Appendix A.

True North Geotechnical, Inc. completed a geotechnical review of the site, dated April 2025. Infiltration testing was performed on site and was deemed insignificant. Groundwater was encountered in test pits 1, 2, 3, 6, 8 and 9. The location of the detention pond has groundwater located 3.5 ft below ground surface. Based on the observed groundwater elevations, infiltration is not feasible on the South end of the site.

Section D – Source Control MR #3

The pollution risks involved with this project mainly include the sediment accumulation involved with construction. The Stormwater Pollution Prevention Plan is a document that notes our certain Best Management Practice's (BMP's) that will help prevent sediment laden water from leaving the site during construction. The Erosion Control Plan located in the final construction drawings will provide protection measures involved with minimizing the chance that sediment from the site could enter downstream waterways. After construction is complete, this project does not necessitate any special source control measures due to abnormal risks associated with the project. As this is a single-family home development, appropriate source control responsibilities will fall primarily on property owner(s). The SWPPP is provided in Appendix E.

Section E – On-site Stormwater Management BMPs MR #5

Minimum Requirement 5 requires the applicant to employ On-site Stormwater Management BMPs in accordance with the following project thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on-site to the maximum extent feasible without causing flooding or erosion impacts. Based on section I-2.5.1 of the Western Washington Stormwater Manual the development is within the UGA on a parcel that is less than 5 acres therefore Low Impact Development Performance Standards and BMP T5.13; or List #2 will apply (applicant option).

To meet Minimum Requirement 5 the applicant proposes a single solution**.** The entire site will comply with LID performance standards and BMP T5.13. The site will meet List #2 as outlined below. All requirements that will be applied to this project are noted below and shown in the final construction drawings. If certain BMP's are infeasible; infeasibility criteria per the 2024 Stormwater Management Manuel for Western Washington are also noted.

<u>List #2 (for the south end of the site only):</u>
Lawn and Landscape areas:
BMP T5.13 Post-Construction Soil Quality and Depth:
This requirement will be met during final design and shown on final construction drawings.

Roofs:
BMP T5.30 or BMPT5.10 Full Dispersion or Downspout Full Infiltration:
There is insufficient area and length to provide a 100' flow path to meet the requirements of full dispersion while still maintaining sufficient spacing to prevent overlap.

BMPT7.30: Bioretention:
The soil permeability factor above groundwater is less than 0.3 inches per hour. Because the site soils don't accommodate infiltration, this is not a feasible BMP as part of Minimum requirement #5.

BMPT5.10B Downspout Dispersion Systems:
There is insufficient space to meet the required dispersion lengths and setbacks from the structures and the property lines.

BMP T5.10C Perforated Stub-out Connections
There is insufficient space to meet the required setback of 10' away from the structures and property lines, and infiltration rates are less than 0.3 inches per hour.

Other Hard Surfaces:
BMP T5.30 Full Dispersion:
There is insufficient area and length to provide a 100' flow path to meet the requirements of full dispersion while still maintaining sufficient spacing to prevent overlap.

BMP T5.15 Permeable Pavement:
Permeable pavement is insufficient due to soil infiltration above the groundwater table being less than 0.3 in/hr.

BMP T7.30: Bioretention:
The soil permeability above the groundwater table is less than 0.3 inches per hour. This is not a feasible solution.

BMP T5.12 Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion:
There is insufficient area and length to provide a 100’ flow path to meet the requirements of full dispersion while still maintaining sufficient spacing to prevent overlap.

None of the List 2 requirements can be met by this project. Consequently, stormwater on the South end of the project will be treated and detained prior to discharge as described in Sections F and G of this report.

The following BMPs will be implemented to meet the minimum 5 requirements:

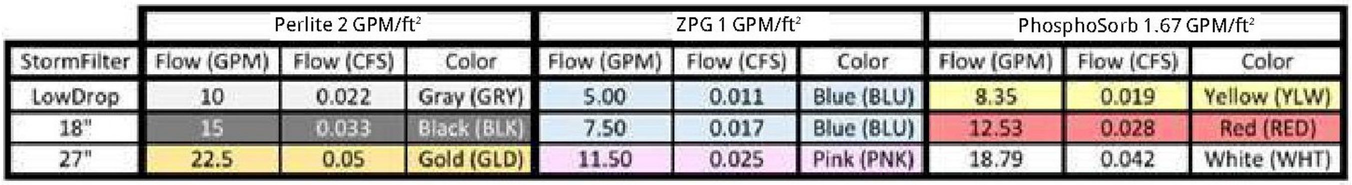
- **BMP T5.13: Post-Construction Soil Quality and Depth** for lawn and landscaped areas.
- **BMP D.1: Detention Ponds** for runoff from the site.

Section F – Runoff Treatment Analysis and Design MR#6

Treatment for the site will be accomplished via media filter cartridges that will be placed in a vault at the south end of the site. The filter system will treat the pollution generating surface runoff that is conveyed to it. Runoff from the building roofs and other non-pollution generating areas will be piped to bypass the filter cartridges when possible. The cartridge units will be sized to treat all the runoff that is routed to them.

For this preliminary phase it is assumed that the entire site will be treated. The Treatment Analysis WWHM model contained in Appendix B identifies an off-line WQ flow of 0.3651 CFS. Per Table 1 below, LowDrop PhosphoSorb cartridges are designed to treat 0.019 CFS each. So, the most LowDrop PhosphoSorb cartridges that would be used for this project will be 20 cartridges contained within a vault before the detention pond at the south end of the site. The final design will evaluate the vault and its sizing.

Table 1-Contech Sizing Chart



	Perlite 2 GPM/ft²			ZPG 1 GPM/ft²			PhosphoSorb 1.67 GPM/ft²		
StormFilter	Flow (GPM)	Flow (CFS)	Color	Flow (GPM)	Flow (CFS)	Color	Flow (GPM)	Flow (CFS)	Color
LowDrop	10	0.022	Gray (GRY)	5.00	0.011	Blue (BLU)	8.35	0.019	Yellow (YLW)
18"	15	0.033	Black (BLK)	7.50	0.017	Blue (BLU)	12.53	0.028	Red (RED)
27"	22.5	0.05	Gold (GLD)	11.50	0.025	Pink (PNK)	18.79	0.042	White (WHT)

Section G - Flow Control Analysis and Design

The stormwater quantity control system for this site has been designed based on the current stormwater quantity control requirements per Ecology’s 2024 SWMMWW, MR#7. The quantity control standards require that stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.

The detention pond mentioned in Section F were modelled in WWHM and successfully stores and releases all of the stormwater runoff from the site without using infiltration. Modeling basins were calculated as a developed site using Soil Group 3 as the underlying soils per the geotechnical recommendation contained in Appendix C. Calculations and values can be seen in Appendix B.

The detention pond design for Basin one has a square footage of 3,030', an equivalent square footage was used for WWHM calculations. The basin has an effective depth of 5', with 3:1 sloped on all sides. It has a riser height of 4', diameter of 18", notch height of 1.25', width of 1', and an orifice diameter of 4.5". The WWHM design model in Appendix B shows that this detention pond exceeds the requirements and can be reduced in size. This preliminary TIR is showing that stormwater for the site can meet the requirements of SWMMWW. The sizes of this facility will be fine-tuned in the final design.

Infiltration does not work if the groundwater is too shallow. Consequently, groundwater depth is a significant issue for this project. The geotechnical investigation discovered ground water in 6 of the test pits. The only test pits to not encounter groundwater are 4, 5 and 7. Because of this infiltration is not used on the site.

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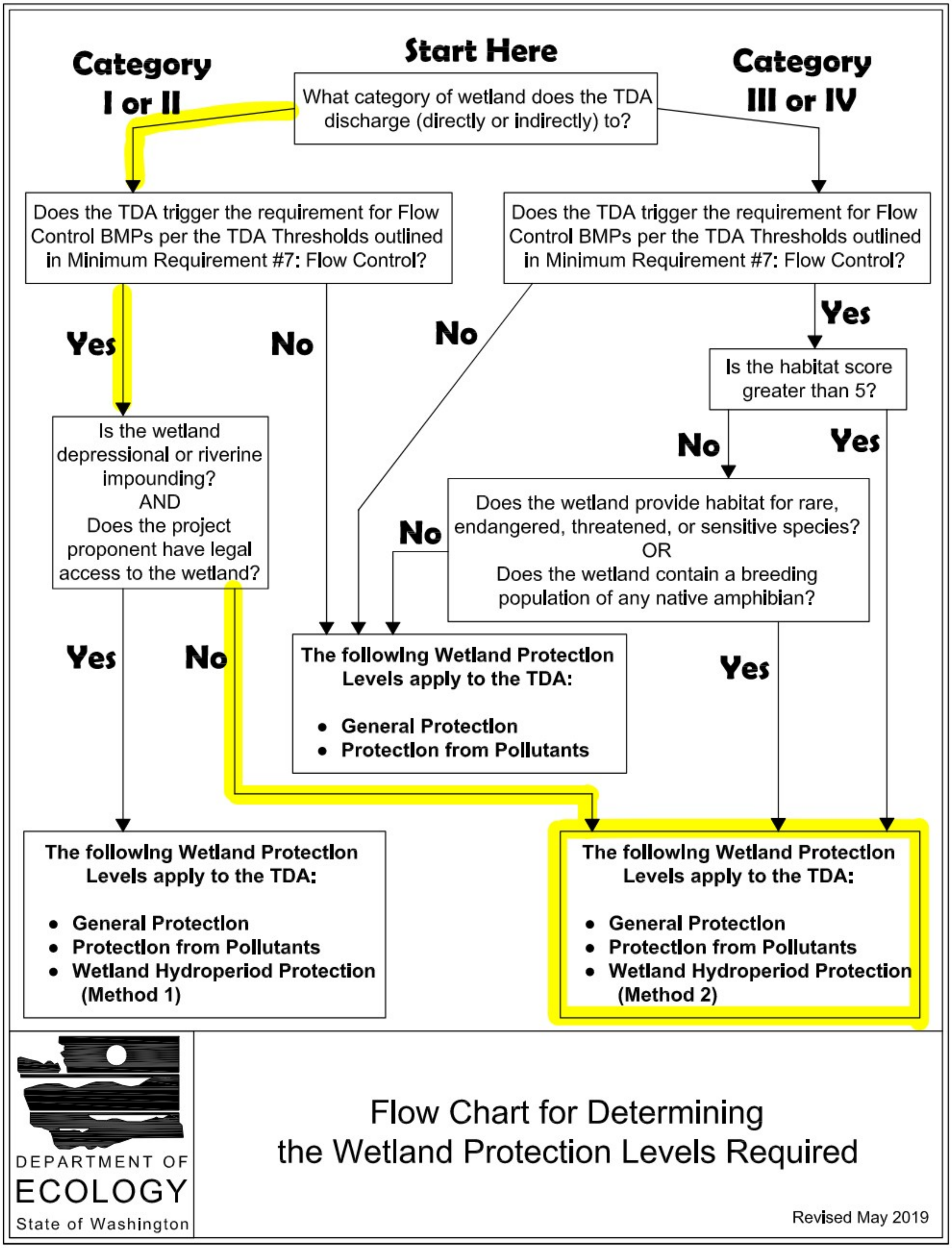

Flow Chart for Determining the Wetland Protection Levels Required

Revised May 2019

Section H – Wetland Protection

2024 SWMMWW I-C.2 General Wetland Protection

All wetlands (Categories I, II, III, and IV) must receive the following general protection:

1. Consult regulations issued under federal and state laws that regulate the discharge of pollutants to surface waters, including the Construction Stormwater General NPDES Permit.

   The site stormwater system has been appropriately designed and complies with federal and state laws and discharging to the wetland in the proposed manner is allowed. Refer to section B of this report for compliance with Minimum Requirements 1-9. An NPDES permit will be applied for and obtained during final engineering design.

2. Maintain the wetland buffer required by City of Camas and federal regulations

   The critical Areas Report produced by Ash Eco Solutions identified a standard buffer of 260'. The wetland is located on the very edge of the southwest border of the sight continuing past the site. Due to site limitations, the project cannot avoid impacting the wetland buffer. The Critical Areas Report discusses a reduction to 195' buffer for the wetland and using buffer averaging.

3. Retain areas of native vegetation connecting the wetland and its buffer with nearby wetlands and other contiguous areas of native vegetation.

   The Critical Areas Report shows a stream connecting to a wetland in the southeast of the project sight. This wetland is upstream and flows down across the sight. Vegetation surrounding the stream, and its buffer, will be avoided to the maximum extent possible.

4. Avoid compaction of soil and introduction of invasive plant or animal species in the wetland and its buffer.

   Most of the wetland exists off site and will not be constructed on, and any onsite wetlands will not be constructed on either. compaction and introduction of invasive species within the buffer will be avoided to the maximum extent feasible.

5. Take measures to avoid general physical impacts (e.g., littering and vegetation destruction). Examples are protecting existing buffer zones; discouraging access, especially by vehicles, by planting outside the wetland, and encouragement of stewardship and signage by landowners.

   The majority of the wetland is located offsite, however physical impacts to the buffer will be avoided to the maximum extent feasible. Silt fencing will be installed along the project grading limits to discourage access to the wetland. Disturbances to the buffer have been accounted for in the critical areas report.

6. Any stormwater management practices, such as Runoff Treatment or Flow Control BMP implementation, must be done outside of the wetland buffer boundary, except limited circumstances where the wetland and/or buffer any be used for additional Runoff Treatment and/or Flow Control of stormwater (See 1-C.6 Compensatory Mitigation of Wetlands)

   No stormwater management or flow control BMPs are implemented inside of a wetland buffer.

7. Discharge from a BMP or project site should be dispersed using a method to diffuse the flow before entering the wetland buffer.

   Upon exiting the detention pond, a riprap pad is used at the outflow point to partially diffuse the flow. Due to elevation constraints and site limitation, it is not possible to diffuse runoff prior to entering the wetland buffer.

8. Consider fences to restrict human access, but make sure it doesn't interfere with wildlife movement. They should be used when wildlife passage is not a major issue and the potential for intrusive impacts is high. When wildlife movement and intrusion are both issues, circumstance will have to weighed to make a decision about fencing. Check with the local and/or state agencies to determine if fencing would be allowed.

   The majority of the wetland is located offsite. Fencing is not being proposed around the wetland or buffer. Intrusive impacts to the wetland are not expected.

2024 SWMMWW I-C.3 Wetland Protection from Pollutants

All wetlands (Categories, I, II, III and IV) must receive the following protection from pollutants:

1. Provide Construction Stormwater BMPs as directed in I-3.4.2 MR2: Construction Stormwater Pollution Prevention Plan (SWPPP) to prevent sediment and other pollutants from entering the wetland.

   A Construction Stormwater BMPs as directed in Book 1, Section 1.5.2 MR #2 Construction Stormwater Pollution Prevention Plan (SWPPP) to prevent sediment and other pollutants from entering the wetland.

2. Provide Source Control BMPs as directed in I-3.4.3 MR3: Source Control of Pollution. Refer to Volume IV and local jurisdiction requirements.

   Refer to Minimum Requirement #3 in Section B of this report for the proposed Source Control BMPs.

3. Provide On-Site Stormwater Management and use LID principles as much as practicable for the site, as directed in I-3.5.4 MR5: On-Site Stormwater Management. LID principles and practices will help meet other wetland hydroperiod protection criteria and provide additional habitat.

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Refer to Minimum Requirement #5 and Section E of this report for the proposed stormwater management BMPs. LID principles were incorporated into the design to the extent feasible.

4. Provide Runoff Treatment for I-3.4.6 MR6: Runoff Treatment to treat runoff prior to entering the wetland and its buffer.

   The storm water will be treated in a vault prior to entering any wetland or its buffer.

2024 SWMMWW I-C.4 Wetland Hydroperiod Protection

The intent of the Wetland Hydroperiod Protection is to maintain the wetland's annual fluctuations in water depth and it's timing as closely as possible (Methods 1 and 2) that are dependent on the wetland category and whether the project has legal access to the wetland.

According to Figure 1.4 (Minimum Requirement #8 Flow Chart) of the 2024 Stormwater Management Manual for Western Washington, Method 2 shall be used for this project.

Criteria for Method 2:

The project proponent must ensure both of the following criteria are met to comply with method 2 of the Wetland Hydroperiod Protection.

> Criteria 1: Mean Daily Total Discharge Volumes from the Site. The total volume of water into the wetland on a daily basis should not be more than 20% higher or lower than the pre-project volumes.
>
> Criteria 2: Mean Monthly Total Discharge Volumes from the Site. The total volume flow of water into the wetland on a monthly basis should not be more than 15% higher or lower than the pro-project volumes.

The Western Washing hydrology model (WWHM) was used to complete the Method 2 modeling.

There are two wetlands associated with this site. One is an offsite Category II wetland located southeast of the site. The area associated with the natural discharge to this wetland is contained and will not be impacted due to the development of the site. There is one on site Category II wetland that is receiving runoff from the site predeveloped conditions. Development will impact the discharge area and discharge volumes to the existing wetland. Wetland hydroperiod protection method 2 will be applied as it is a category 2 slope wetland.

Off-site Wetland A Category II Method 2 Hydroperiod Protection Analysis:

Per I-C.5 Wetland Hydroperiod Protection; Method 2

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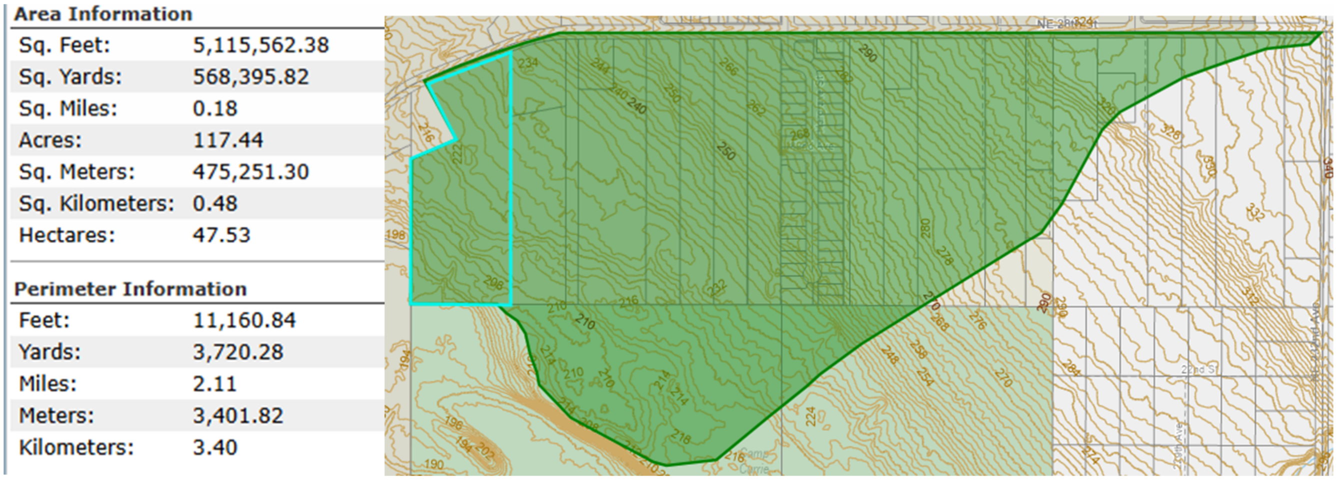
Pre-Project Scenario:

Step 1: Identify existing impervious and pervious surfaces that discharge to the wetland and use the model elements to represent these land areas.

Due to the large contributing basin of the on-site Category II wetland the Clark County GIS software was used to evaluate the existing contours and existing drainage infrastructure to assess the contributing discharge basin that provides hydrology to the wetland both on and off-site. The approximate total area that contributed to the wetland was determined to be 5,115,562.38 square feet (117.44 acres). The contributing area is shown below.



Area Information

Sq. Feet:	5,115,562.38
Sq. Yards:	568,395.82
Sq. Miles:	0.18
Acres:	117.44
Sq. Meters:	475,251.30
Sq. Kilometers:	0.48
Hectares:	47.53

Perimeter Information

Feet:	11,160.84
Yards:	3,720.28
Miles:	2.11
Meters:	3,401.82
Kilometers:	3.40

After the basin boundary was determined the existing pervious and impervious areas offsite were determined with the use off google arial images, Clarg County GIS, and scaled maps with Bluebeam software. The on and off-site pervious and impervious areas are detailed below.

Onsite Pre-Project Areas

Basin	Surface Cover	Area (AC)
1	Forest	8.6377

Off-site Pre-Project Area

Surface Cover	Area (AC)
Roof	2.3306
Road	1.1934
Gravel	3.2286
Forest	56.7077
Fields	53.9768
Total	117.4372

To represent the pervious and impervious land area in WWHM, lateral flow basin elements were used. For all lawn, field and forested land areas pervious later basins were utilized. For all grave roads and roof areas and impervious later basin elements were used.

Step 2: Identify the wetland buffer area and use the lateral flow soil basin to represent the wetland buffer.

To determine the area of the wetland buffer, a 190' moderate LUI buffer was measured using Bluebeam, the area was modeled in WWHM with the later flow soil basin.

The Wetland Buffer area was determined to be **81.0229 acres.**

The determined 260' moderate LUI buffer expands onto the project site. Of the 8.6377 acres of onsite area, only 5.1363 acres were determined as part of the wetland buffer.

Step 3: Connect the model elements to the wetland buffer ensuring that impervious land areas are connected to surface flows and that for any other model elements all flows are connected.

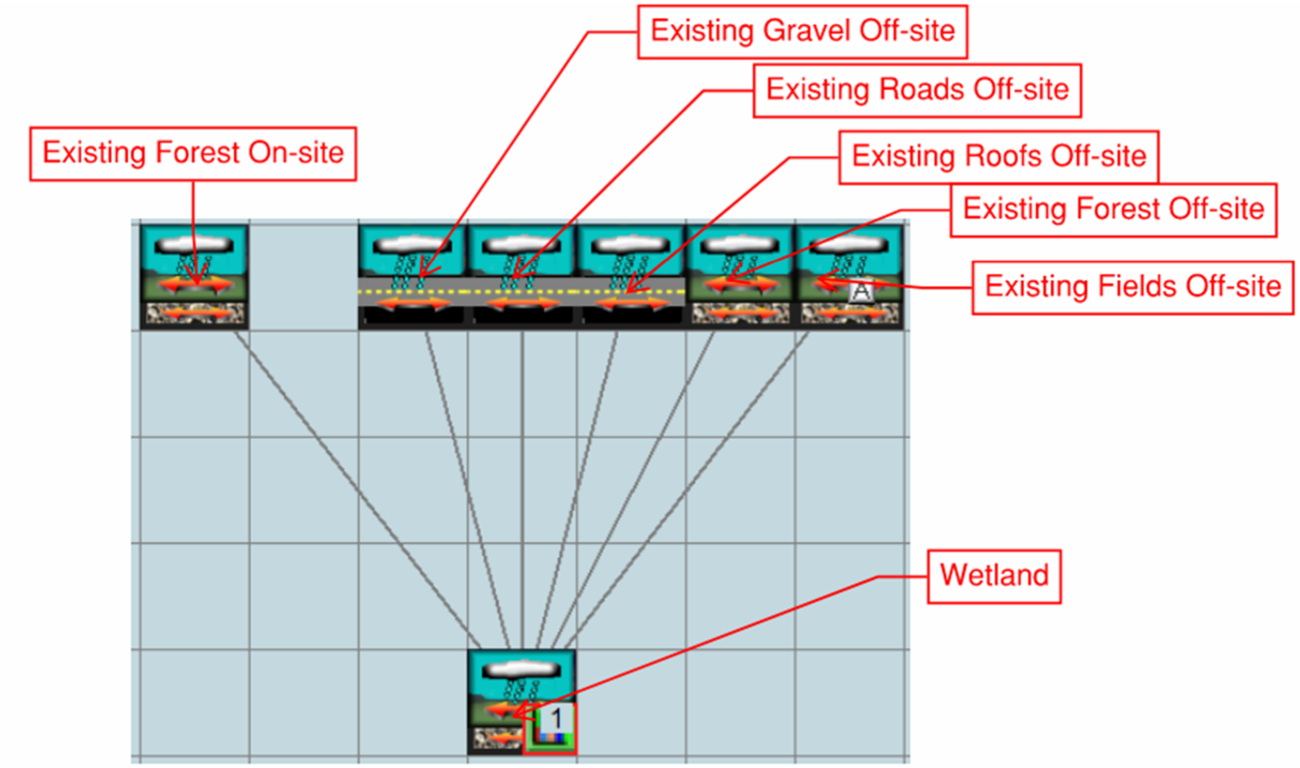
The land use areas determined in steps one and two were associated to the proper lateral basins. The onsite lateral basin and all off-site lateral basins elements were individually connected to the lateral basin representing the wetland buffer.

Step 4: Set the wetland buffer element as the most downstream element:

The later basin representing the wetland buffer is set as the downstream basin, where all other basins are connected to discharge to the wetland basin.

Step 5: Set the POC at the outflow of the wetland buffer element including surface runoff, interflow and groundwater.

Ex Wetland lateral basin element attached to POC 1 including surface runoff, interflow and groundwater.



Post-project Simulation:

Step 1: Identify anticipated post-project impervious and pervious surfaces that discharge to the wetland and use the model elements to represent these land areas.

Of the 8.6377 acres of on site, predeveloped land cover, both in and outside of the buffer range, all 8.6377 will be routed through the wetland. All off-site areas will remain the same post-Project.

Onsite Post-Project Area

Basin	Surface Cover	Area (AC)
1	Lawn	2.5194
1	Roof	6.1183

Off-Site Post-Project Area

Surface Cover	Area (AC)
Roof	2.3306
Road	1.1934
Gravel	3.2286
Forest	59.7077
Fields	53.9798
Total	117.4372

Step 2: Identify any Flow Control BMPs and use the appropriate model elements to represent these facilities

All flow discharging from the developed site to the studied wetland are discharging via detention pond.

Step 3: Identify the wetland buffer area and use the lateral flow soil basin to represent the wetland buffer.

The wetland buffer area will decrease to the 195' moderate LUI buffer and will further decrease by 26,271 square feet for the buffer reduction area mentioned on page 30 of the critical areas report in appendix F.

Step 4: Connect the model elements to the wetland buffer ensuring that impervious land areas are connected to surface flows and that for any other model elements all flows are connected.

Post-project lateral basins are connected to the wetland elements. All basins used are pervious lateral flow basins connected via surface flow, interflow and groundwater.

Step 5: Connect any flow control BMPS elements to the wetland buffer ensuring that surface flows are connected to surface water and any infiltration is connected to ground water.

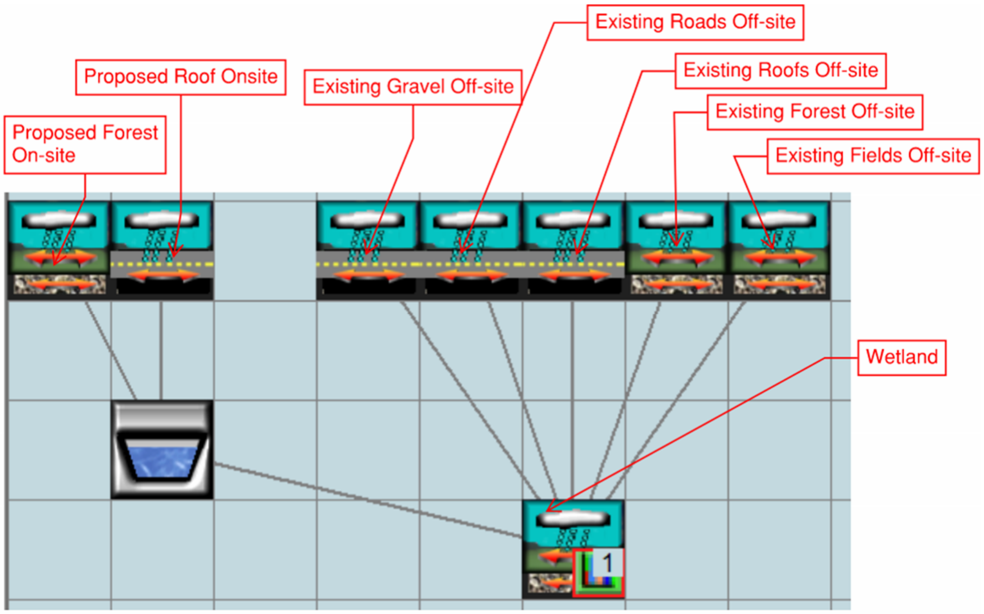
The detention pond is connected to the onsite lateral basins and connected to the wetland out of outlet one and into surface flow.

Step 6: Set the wetland buffer element to the most downstream element.

All lateral basins are set to connect to the wetland element.

Step 7: Set the POC at the outflow of the wetland buffer element including surface runoff, interflow and groundwater.

POC 1 is connected to the wetland element set to be the outflow including surface runoff, interflow, and groundwater.



Both scenarios were run, and then POC 1 was analyzed via the Wetland Input Volumes analysis. The model passed all 365 days of criteria 1 and passed all 12 months of criteria 2.

WWHM Reports can be found in Appendix B.

The model as ran and the results were analyzed. The system passed all 365 days of Criterion 1 and passed all 12 months of Criterion 2. The full WWHM report is attached.

Section I – Other Permits

The project will be required to obtain Final Decision issued by Hearing Examiner, civil engineering plan approval, and NPDES construction stormwater permit.

Section J – Conveyance Systems Analysis and Design

Preliminary calculations were done in HydroCAD and a 15” storm pipe will be able to convey all water through the site. Conveyance will be provided with the Final TIR.

Section K – Special Reports and Studies

A Geotechnical Report for the site was prepared by True North, Inc. and is included in Appendix C. A Critical Areas report is included in Appendix F. No other special studies are anticipated to be needed.

Section L –Operations and Maintenance Manual

The stormwater facility located on-site will be maintained by the site owner. An Operations and Maintenance Manual is included as Appendix D of this report.

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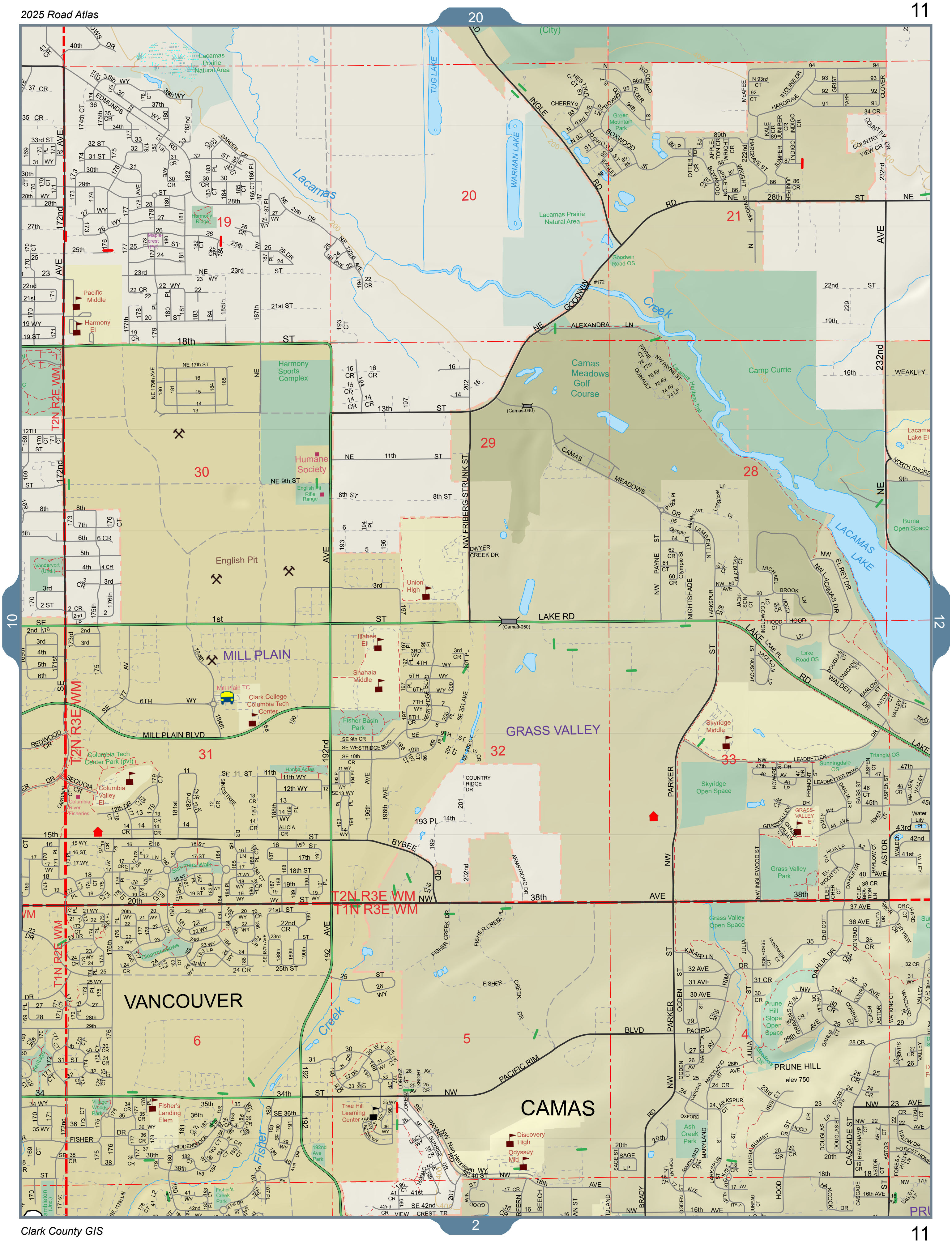
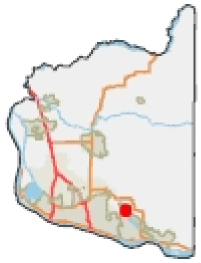
APPENDIX A

Maps


20
10
12
2
VANCOUVER
CAMAS
MILL PLAIN
GRASS VALLEY
PRUNE HILL
Lacamas Lake
T2N R3E WM
T1N R3E WM



Legend

- ☐ Taxlots
- 🟫 Severe Erosion Hazard Areas
- Steep Slopes and Landslide H
  - 🟥 Areas of Historic or Active Landslid
  - 🟧 Areas of Potential Instability
  - 🟫 Areas of Older Landslide Debris
  - 🟩 Slopes > 15%
  - 🟩 Slopes > 25%
- 🟩 Permitted Wetland
- 🟩 NWI Wetland
- — Stream
- 🟦 Lake
- Shoreline Designations
  - 🟦 Aquatic
  - 🟩 Natural
  - 🟫 Urban Conservancy
  - 🟧 Medium Intensity
  - 🟥 High Intensity
  - 🟨 Rural Conservancy Residential
  - 🟪 Rural Conservancy Resource Land

Notes:

752.3 0 376.17 752.3 Feet

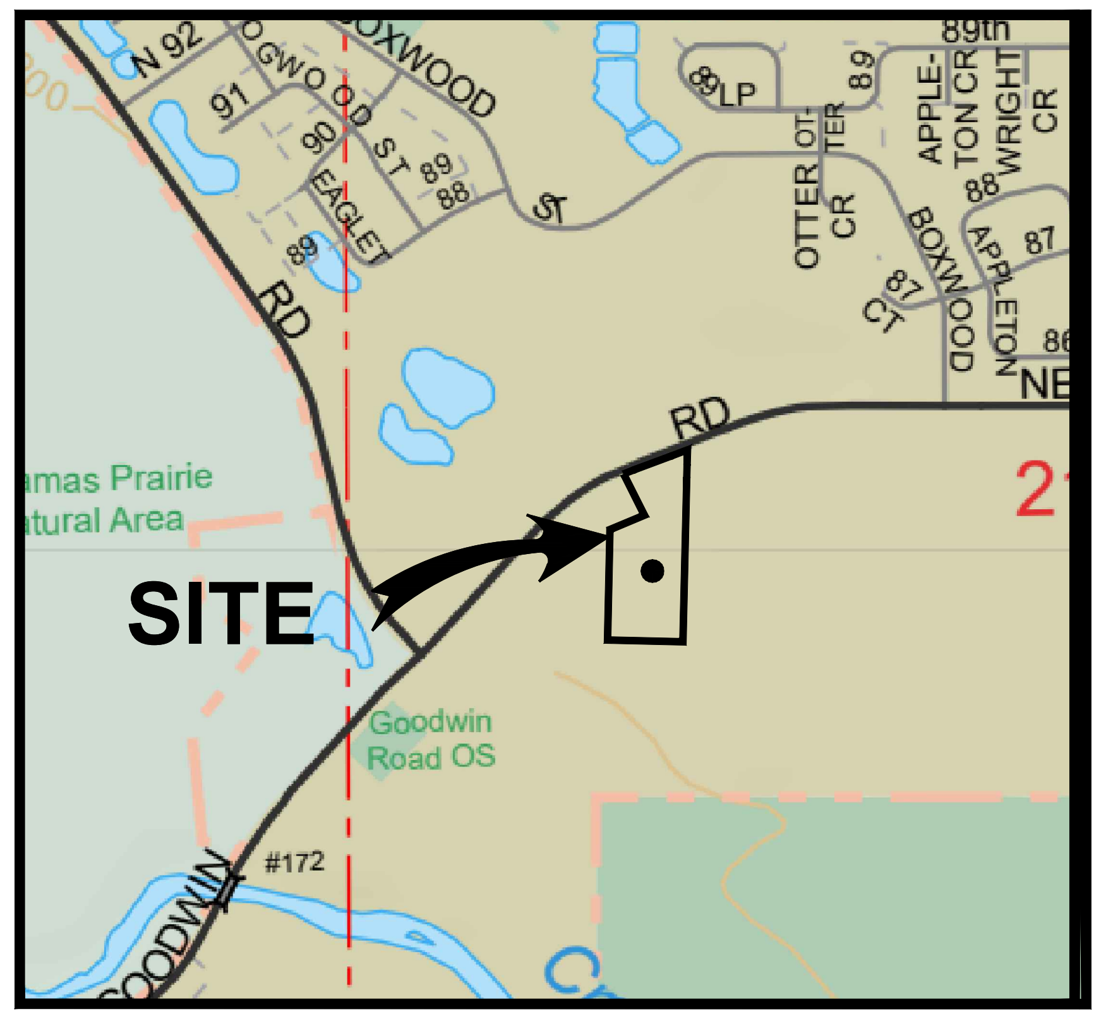
WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Reserve at Green Mountain

Located in the SE ¼ of Section 21, T2N, R3E and in
the SW ¼ of Section 21, T2N, R3E, W.M.
Camas, Washington

Sheet Index

1. Predevelopment Basin Map
2. Postdevelopment Basin Map



VICINITY MAP
NOT TO SCALE

GENERAL NOTES

Applicant:
Pacific Lifestyle Homes
11815 NE 99th Street
Vancouver, WA 98682
Office (360) 304-9901

OWNER:
Marwan Bahu
PO Box 744
San Clemente, CA 92672

CIVIL ENGINEER:
PLS Engineering
Contact: Travis Johnson, PE
604 W Evergreen Blvd
Vancouver, WA 98660
PH: (360) 944-6519
pm@plsengineering.com

SITE ADDRESS:
Parcel # 173192-000
2625 NE GOODWIN RD
Camas, WA 98607

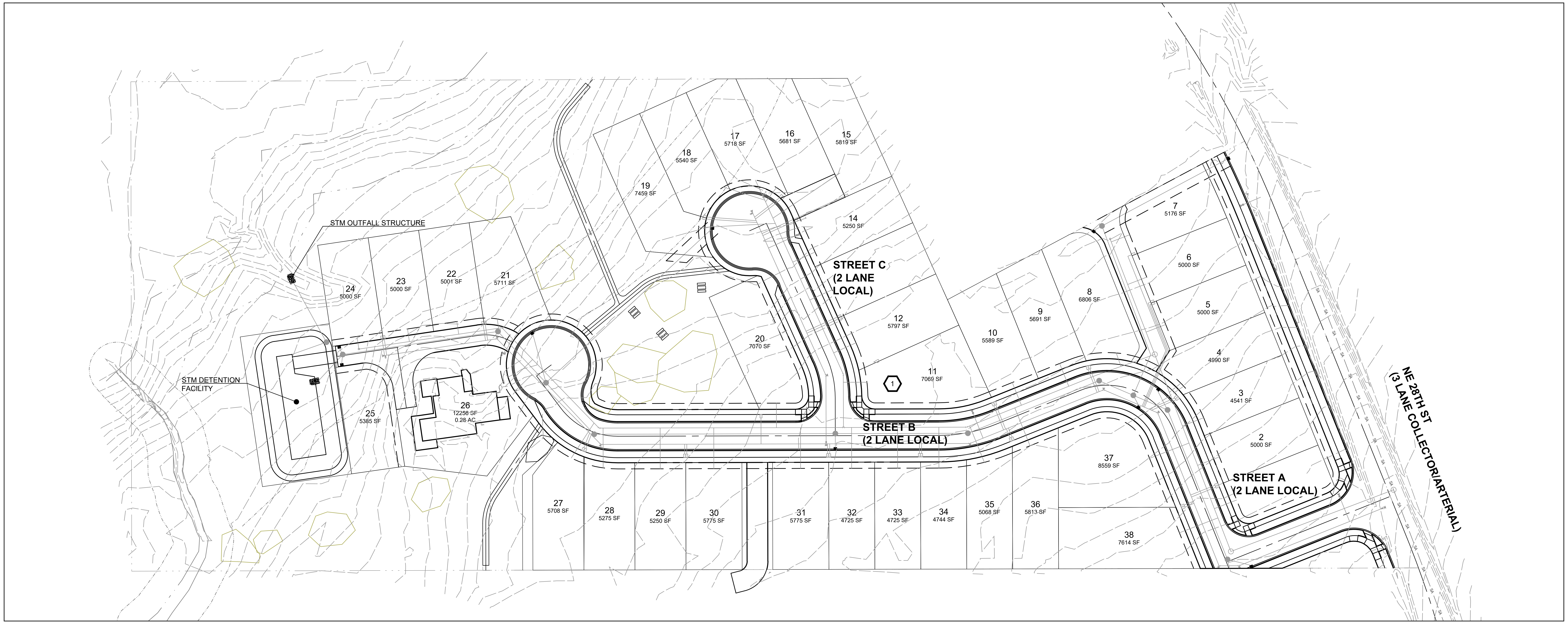
⬡1 Point of Compliance 1: Post-Development Basin Area

Basin 1 Areas:	
Road:	1.34 ac
Sidewalk:	0.33 ac
Roof:	4.06 ac
Driveway:	0.38 ac
Landscape:	2.52 ac
Total:	8.64 ac
Total POC 1 Area:	8.64 ac

Drainage Basin Legend

POC Line	▬ ▬ ▬
Basin Line	— · — · —
Subcatchment Area ID	⬡#

Scale 1" = 50'



PLS ENGINEERING

Post-Development Basin Map For:

Reserve at Green Mountain

A Subdivion Located In The City Of Camas, Washington

Engineering - Surveying - Planning | 604 W. Evergreen Blvd., Vancouver, WA 98660 | PH (360) 944-6519 | Fax (360) 944-6539

Revisions
1
2
3
4
5
6

Project No. 3927

SCALE:	H: 1" = 50' V: N/A
DESIGNED BY:	###
DRAFTED BY:	###
REVIEWED BY:	###

2
2

Reserve at Green Mountain

Located in the SE ¼ of Section 21, T2N, R3E and in
the SW ¼ of Section 21, T2N, R3E, W.M.
Camas, Washington

Sheet Index

1. Predevelopment Basin Map
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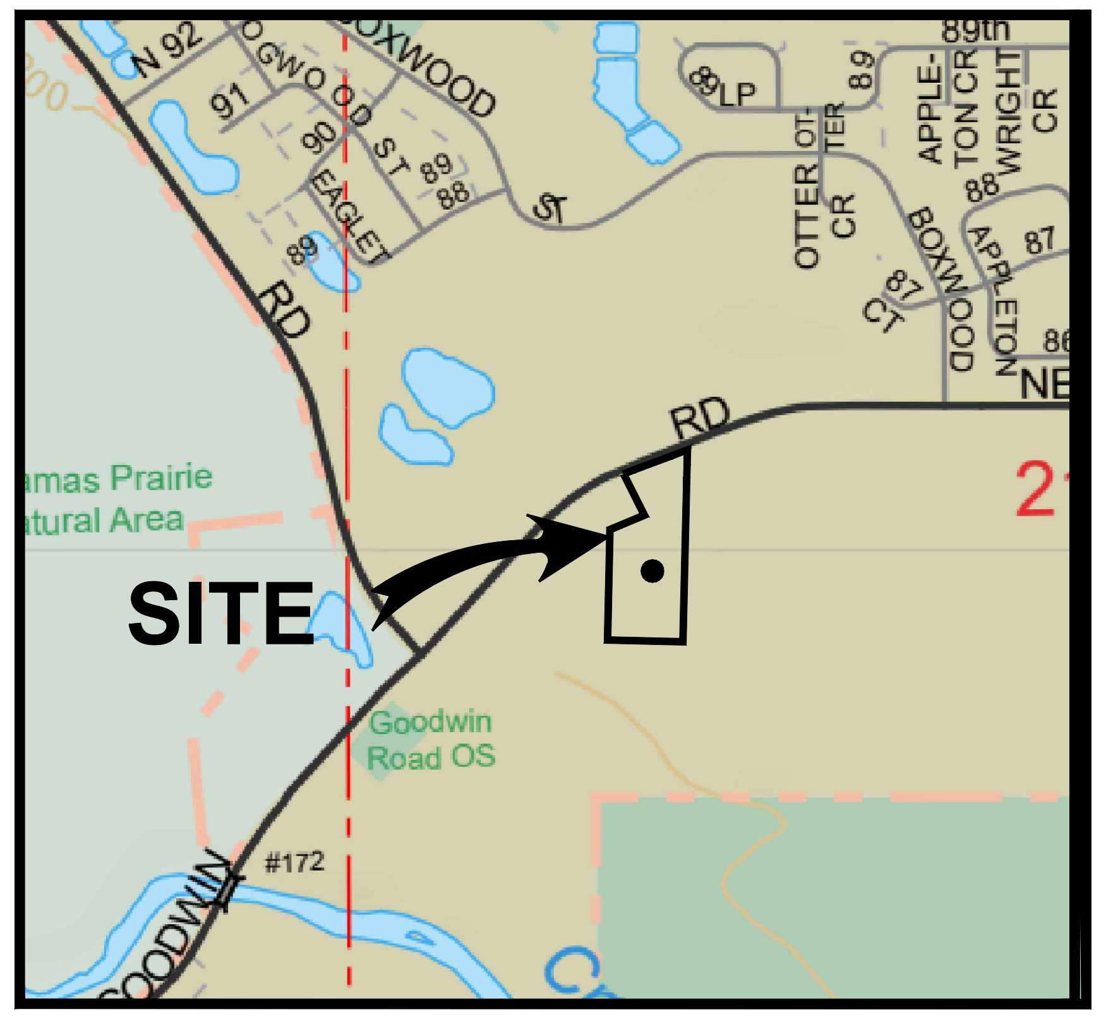

VICINITY MAP
NOT TO SCALE

1 Point of Compliance 1: Pre-Development Basin Area

Basin 1 Areas:	
Landscape:	8.64 ac
Total:	8.64 ac
Total POC 1 Area:	8.64 ac

Drainage Basin Legend

POC Line	▬ ┈ ▬ ┈ ▬
Basin Line	— · — · —
Subcatchment Area ID	#

Scale 1" = 50'
50 25 0 50

Pre-Development Basin Map For:

Reserve at Green Mountain

A Subdivion Located In The City Of Camas, Washington

PLS ENGINEERING
Engineering - Surveying - Planning | 604 W. Evergreen Blvd., Vancouver, WA 98660 | PH (360) 944-6519 | Fax (360) 944-6539

Revisions
1
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Project No. 3927

SCALE:	H: 1" = 50' V: N/A
DESIGNED BY:	###
DRAFTED BY:	###
REVIEWED BY:	###

1
2

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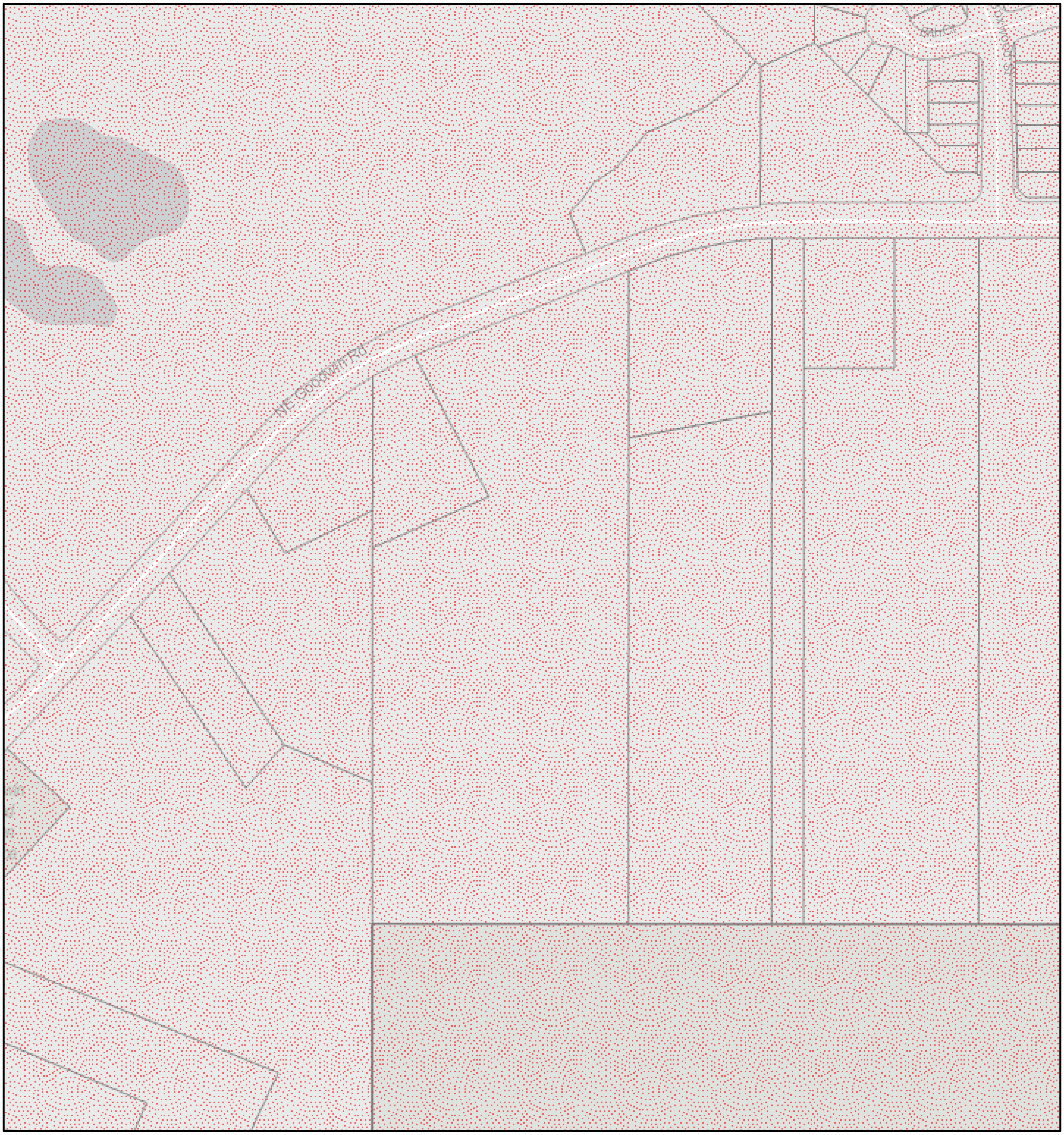
Reserve at Green Mountain Critical Aquifer Recharge Area



5/12/2025

☐ Taxlots Public

Critical Aquifer Recharge Area

▨ Category 2 Recharge Areas

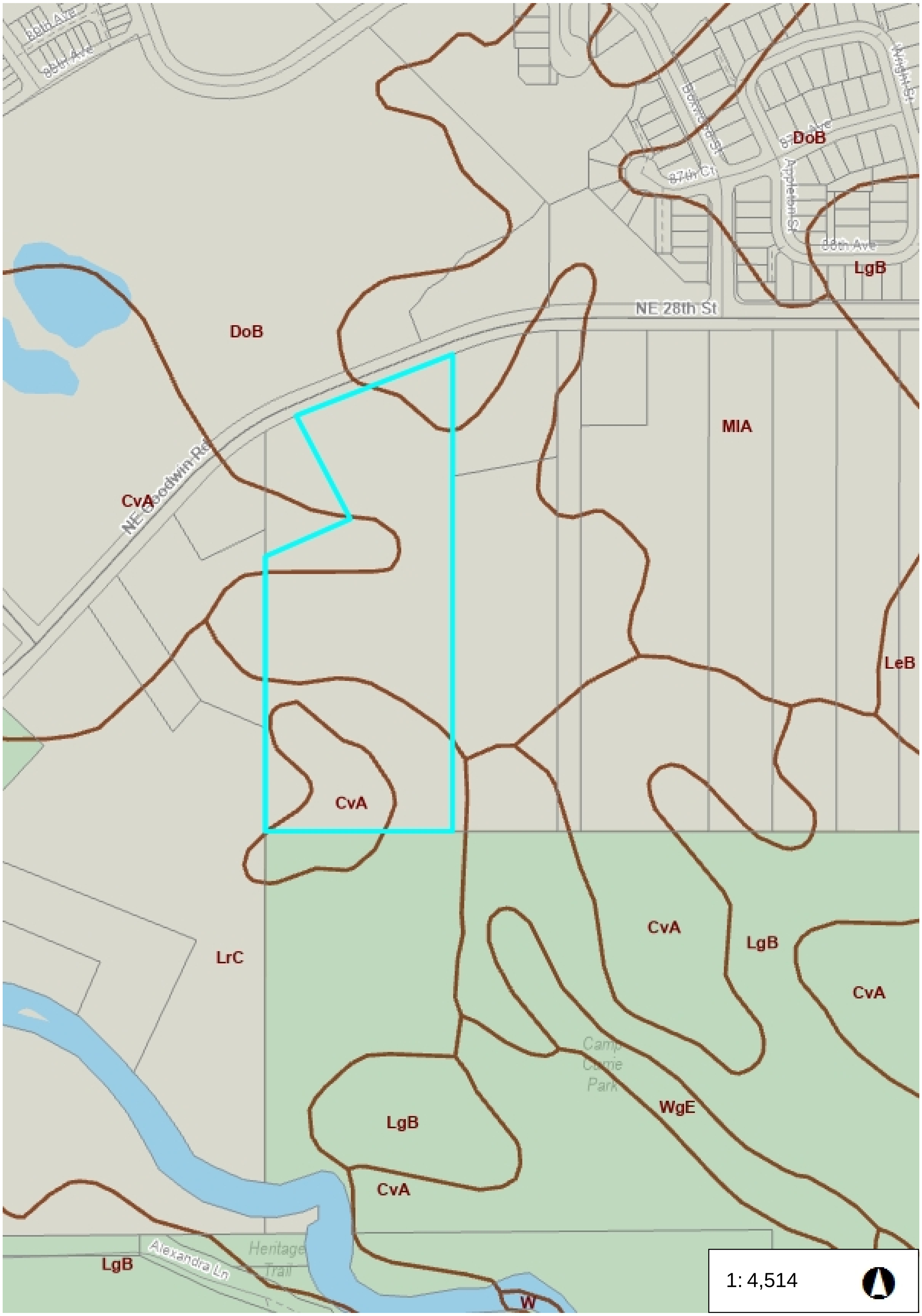
Light_Gray_Canvas_Base

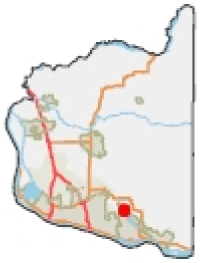
1:4,523

0 0.03 0.06 0.11 mi

0 0.04 0.09 0.17 km

County of Clark, Oregon Metro, Bureau of Land Management, State of Oregon, State of Oregon DOT, State of Oregon GEO, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, EPA, Clark County WA





Legend

☐ Taxlots

🟫 Soil Type

Notes:

752.3 0 376.17 752.3 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Exhibit 21 SUB25-1004

APPENDIX B

Design Calculations and Modeling

Exhibit 21 SUB25-1004

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Hydropperiod Protection Detention Pond

Site Name:	
Site Address:	
City:	
Report Date:	5/19/2025
MGS Region:	
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
DOT Data Number	00
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Ex Forest Offsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Mod	56.4623

Ex Roads Offsite

Bypass:	No
Impervious Land Use	acre
ROADS FLAT	1.1934

Ex Forest Onsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Mod	8.6377

Ex Roof Offsite

Bypass:	No
Impervious Land Use	acre
ROOF TOPS FLAT	2.3306

Ex Driveway\\Gravel Offsite

Bypass:	No
Impervious Land Use	acre
DRIVEWAYS FLAT	3.2286

Ex Field Offsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Field, Flat	53.9768

Lateral Basin 4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Mod	81.0229

Mitigated Land Use

Ex Roads Offsite

Bypass:	No
Impervious Land Use	acre
ROADS FLAT	1.1934

Ex Forest Offsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Mod	56.4623

Ex Roof Offsite

Bypass:	No
Impervious Land Use	acre
ROOF TOPS FLAT	2.3306

Ex Driveway Offsite

Bypass:	No
Impervious Land Use	acre
DRIVEWAYS FLAT	3.2286

Lateral Basin 2

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Mod	65.2919

Ex Field Offsite

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Field, Flat	53.9768

Lateral Basin 4

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Flat	2.5194

Lateral I Basin 4

Bypass:	No
Impervious Land Use	acre
ROOF TOPS FLAT	6.1183

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Routing Elements

Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length:	100.00 ft.
Bottom Width:	30.30 ft.
Depth:	5 ft.
Volume at riser head:	0.4481 acre-feet.
Side slope 1:	3 To 1
Side slope 2:	3 To 1
Side slope 3:	3 To 1
Side slope 4:	3 To 1
Discharge Structure	
Riser Height:	4 ft.
Riser Diameter:	18 in.
Notch Type:	Rectangular
Notch Width:	1.000 ft.
Notch Height:	1.250 ft.
Orifice 1 Diameter:	4.500 in. Elevation:0 ft.

Element Flows To:

Outlet 1	Outlet 2
Lateral Basin 2	

Pond Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.069	0.000	0.000	0.000
0.0556	0.070	0.003	0.129	0.000
0.1111	0.071	0.007	0.183	0.000
0.1667	0.072	0.011	0.224	0.000
0.2222	0.073	0.015	0.259	0.000
0.2778	0.074	0.020	0.289	0.000
0.3333	0.075	0.024	0.317	0.000
0.3889	0.076	0.028	0.342	0.000
0.4444	0.077	0.032	0.366	0.000
0.5000	0.078	0.037	0.388	0.000
0.5556	0.079	0.041	0.409	0.000
0.6111	0.080	0.045	0.429	0.000
0.6667	0.081	0.050	0.448	0.000
0.7222	0.083	0.055	0.467	0.000
0.7778	0.084	0.059	0.484	0.000
0.8333	0.085	0.064	0.501	0.000
0.8889	0.086	0.069	0.518	0.000
0.9444	0.087	0.073	0.534	0.000
1.0000	0.088	0.078	0.549	0.000
1.0556	0.089	0.083	0.564	0.000
1.1111	0.090	0.088	0.579	0.000
1.1667	0.091	0.093	0.593	0.000
1.2222	0.092	0.098	0.607	0.000
1.2778	0.093	0.104	0.621	0.000
1.3333	0.095	0.109	0.634	0.000
1.3889	0.096	0.114	0.647	0.000
1.4444	0.097	0.120	0.660	0.000
1.5000	0.098	0.125	0.673	0.000
1.5556	0.099	0.131	0.685	0.000
1.6111	0.100	0.136	0.697	0.000
1.6667	0.101	0.142	0.709	0.000
1.7222	0.102	0.147	0.721	0.000

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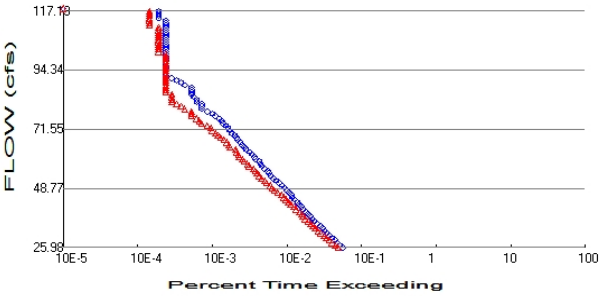
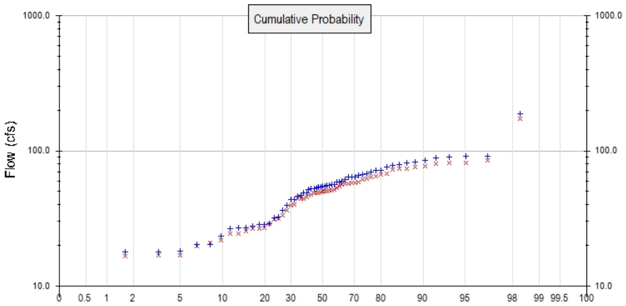
1.7778	0.104	0.153	0.732	0.000
1.8333	0.105	0.159	0.744	0.000
1.8889	0.106	0.165	0.755	0.000
1.9444	0.107	0.171	0.766	0.000
2.0000	0.108	0.177	0.777	0.000
2.0556	0.109	0.183	0.787	0.000
2.1111	0.111	0.189	0.798	0.000
2.1667	0.112	0.195	0.808	0.000
2.2222	0.113	0.201	0.819	0.000
2.2778	0.114	0.208	0.829	0.000
2.3333	0.115	0.214	0.839	0.000
2.3889	0.117	0.221	0.849	0.000
2.4444	0.118	0.227	0.859	0.000
2.5000	0.119	0.234	0.868	0.000
2.5556	0.120	0.241	0.878	0.000
2.6111	0.122	0.247	0.888	0.000
2.6667	0.123	0.254	0.897	0.000
2.7222	0.124	0.261	0.906	0.000
2.7778	0.125	0.268	0.931	0.000
2.8333	0.127	0.275	1.005	0.000
2.8889	0.128	0.282	1.106	0.000
2.9444	0.129	0.289	1.228	0.000
3.0000	0.130	0.296	1.368	0.000
3.0556	0.132	0.304	1.523	0.000
3.1111	0.133	0.311	1.691	0.000
3.1667	0.134	0.319	1.873	0.000
3.2222	0.136	0.326	2.067	0.000
3.2778	0.137	0.334	2.271	0.000
3.3333	0.138	0.341	2.486	0.000
3.3889	0.139	0.349	2.712	0.000
3.4444	0.141	0.357	2.946	0.000
3.5000	0.142	0.365	3.191	0.000
3.5556	0.143	0.373	3.443	0.000
3.6111	0.145	0.381	3.705	0.000
3.6667	0.146	0.389	3.974	0.000
3.7222	0.147	0.397	4.252	0.000
3.7778	0.149	0.405	4.537	0.000
3.8333	0.150	0.414	4.830	0.000
3.8889	0.151	0.422	5.131	0.000
3.9444	0.153	0.430	5.438	0.000
4.0000	0.154	0.439	5.752	0.000
4.0556	0.155	0.448	5.968	0.000
4.1111	0.157	0.456	6.355	0.000
4.1667	0.158	0.465	6.849	0.000
4.2222	0.160	0.474	7.419	0.000
4.2778	0.161	0.483	8.039	0.000
4.3333	0.162	0.492	8.680	0.000
4.3889	0.164	0.501	9.315	0.000
4.4444	0.165	0.510	9.915	0.000
4.5000	0.167	0.519	10.45	0.000
4.5556	0.168	0.529	10.92	0.000
4.6111	0.169	0.538	11.30	0.000
4.6667	0.171	0.548	11.59	0.000
4.7222	0.172	0.557	11.82	0.000
4.7778	0.174	0.567	12.10	0.000
4.8333	0.175	0.576	12.33	0.000
4.8889	0.177	0.586	12.55	0.000
4.9444	0.178	0.596	12.76	0.000

5.0000	0.180	0.606	12.96	0.000
5.0556	0.181	0.616	13.17	0.000

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area:	200.0997
Total Impervious Area:	6.7526

Mitigated Landuse Totals for POC #1

Total Pervious Area:	178.2504
Total Impervious Area:	12.8709

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	51.960228
5 year	79.150971
10 year	93.718194
25 year	108.429242
50 year	117.125046
100 year	124.251301

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	48.075756
5 year	70.378961
10 year	82.012334
25 year	93.587823
50 year	100.359271
100 year	105.873019

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	39.265	36.236
1950	51.465	46.692
1951	69.538	62.212
1952	46.999	45.366
1953	56.426	51.561
1954	75.411	68.028
1955	43.517	39.785
1956	83.087	76.549
1957	63.885	57.953
1958	59.094	56.960

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1959	26.709	24.271
1960	28.777	26.570
1961	71.650	64.227
1962	58.426	53.337
1963	59.934	54.462
1964	53.989	48.852
1965	53.332	48.899
1966	63.715	57.679
1967	52.706	49.678
1968	65.368	59.001
1969	52.384	47.323
1970	188.317	171.710
1971	32.407	31.172
1972	49.049	44.506
1973	54.524	50.738
1974	78.726	72.871
1975	43.365	39.588
1976	63.524	57.201
1977	2.731	4.749
1978	88.860	80.143
1979	67.615	64.606
1980	36.258	33.157
1981	81.643	74.192
1982	55.446	50.055
1983	91.446	81.232
1984	28.681	26.426
1985	23.439	21.886
1986	27.601	25.517
1987	48.594	44.427
1988	17.941	16.615
1989	20.285	19.647
1990	20.416	20.878
1991	53.812	48.636
1992	61.070	56.569
1993	71.860	66.727
1994	54.862	49.915
1995	46.187	44.208
1996	89.990	85.320
1997	90.947	80.937
1998	78.431	73.797
1999	56.196	50.678
2000	26.939	24.242
2001	17.822	16.757
2002	84.674	75.908
2003	67.190	61.410
2004	18.128	16.863
2005	28.709	27.125
2006	55.566	50.443
2007	27.013	29.047
2008	32.090	31.309

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	188.3170	171.7100
2	91.4455	85.3196
3	90.9469	81.2324
4	89.9895	80.9368

5	88.8604	80.1425
6	84.6742	76.5494
7	83.0865	75.9083
8	81.6432	74.1919
9	78.7262	73.7967
10	78.4305	72.8710
11	75.4114	68.0284
12	71.8597	66.7274
13	71.6503	64.6056
14	69.5380	64.2266
15	67.6148	62.2124
16	67.1904	61.4097
17	65.3678	59.0006
18	63.8846	57.9527
19	63.7149	57.6787
20	63.5238	57.2007
21	61.0697	56.9602
22	59.9337	56.5690
23	59.0937	54.4624
24	58.4264	53.3368
25	56.4259	51.5606
26	56.1963	50.7375
27	55.5661	50.6777
28	55.4463	50.4431
29	54.8622	50.0547
30	54.5240	49.9146
31	53.9890	49.6780
32	53.8120	48.8993
33	53.3324	48.8523
34	52.7055	48.6356
35	52.3840	47.3227
36	51.4645	46.6915
37	49.0492	45.3658
38	48.5943	44.5060
39	46.9986	44.4267
40	46.1870	44.2082
41	43.5172	39.7848
42	43.3646	39.5880
43	39.2653	36.2355
44	36.2575	33.1573
45	32.4070	31.3091
46	32.0901	31.1724
47	28.7771	29.0471
48	28.7087	27.1246
49	28.6813	26.5703
50	27.6010	26.4257
51	27.0126	25.5166
52	26.9390	24.2711
53	26.7092	24.2424
54	23.4394	21.8859
55	20.4163	20.8782
56	20.2853	19.6465
57	18.1275	16.8630
58	17.9405	16.7573
59	17.8219	16.6145
60	2.7312	4.7488

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Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
25.9801	1174	1024	87	Pass
26.9008	1083	931	85	Pass
27.8214	993	847	85	Pass
28.7421	914	777	85	Pass
29.6627	846	707	83	Pass
30.5834	781	669	85	Pass
31.5040	723	602	83	Pass
32.4247	673	548	81	Pass
33.3454	631	505	80	Pass
34.2660	588	473	80	Pass
35.1867	532	434	81	Pass
36.1073	498	404	81	Pass
37.0280	463	370	79	Pass
37.9486	437	346	79	Pass
38.8693	403	328	81	Pass
39.7900	372	306	82	Pass
40.7106	347	276	79	Pass
41.6313	328	261	79	Pass
42.5519	308	237	76	Pass
43.4726	291	221	75	Pass
44.3932	269	206	76	Pass
45.3139	251	192	76	Pass
46.2345	241	178	73	Pass
47.1552	222	157	70	Pass
48.0759	207	143	69	Pass
48.9965	195	132	67	Pass
49.9172	182	126	69	Pass
50.8378	166	112	67	Pass
51.7585	150	105	70	Pass
52.6791	139	95	68	Pass
53.5998	127	90	70	Pass
54.5204	120	84	70	Pass
55.4411	116	79	68	Pass
56.3618	104	75	72	Pass
57.2824	98	66	67	Pass
58.2031	93	62	66	Pass
59.1237	90	56	62	Pass
60.0444	79	53	67	Pass
60.9650	76	48	63	Pass
61.8857	71	47	66	Pass
62.8063	67	44	65	Pass
63.7270	59	43	72	Pass
64.6477	56	36	64	Pass
65.5683	53	35	66	Pass
66.4890	50	33	66	Pass
67.4096	46	30	65	Pass
68.3303	44	27	61	Pass
69.2509	42	25	59	Pass
70.1716	38	23	60	Pass
71.0923	36	21	58	Pass
72.0129	34	20	58	Pass
72.9336	32	18	56	Pass
73.8542	29	15	51	Pass

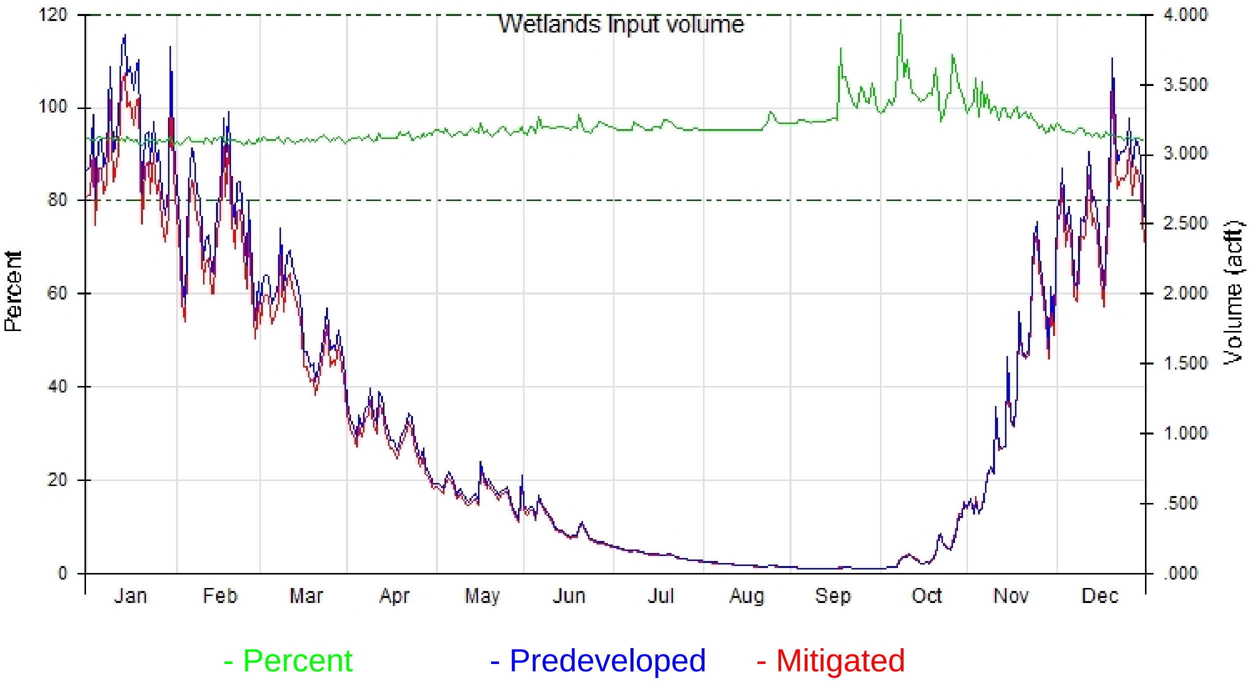
74.7749	28	14	50	Pass
75.6955	26	13	50	Pass
76.6162	23	11	47	Pass
77.5368	21	11	52	Pass
78.4575	18	11	61	Pass
79.3782	15	9	60	Pass
80.2988	15	8	53	Pass
81.2195	15	7	46	Pass
82.1401	13	6	46	Pass
83.0608	13	6	46	Pass
83.9814	12	6	50	Pass
84.9021	11	6	54	Pass
85.8227	11	5	45	Pass
86.7434	11	5	45	Pass
87.6641	11	5	45	Pass
88.5847	9	5	55	Pass
89.5054	8	5	62	Pass
90.4260	7	5	71	Pass
91.3467	6	5	83	Pass
92.2673	5	5	100	Pass
93.1880	5	5	100	Pass
94.1086	5	5	100	Pass
95.0293	5	5	100	Pass
95.9500	5	5	100	Pass
96.8706	5	5	100	Pass
97.7913	5	5	100	Pass
98.7119	5	5	100	Pass
99.6326	5	5	100	Pass
100.5532	5	5	100	Pass
101.4739	5	4	80	Pass
102.3946	5	4	80	Pass
103.3152	5	4	80	Pass
104.2359	5	4	80	Pass
105.1565	5	4	80	Pass
106.0772	5	4	80	Pass
106.9978	5	4	80	Pass
107.9185	5	4	80	Pass
108.8391	5	4	80	Pass
109.7598	5	4	80	Pass
110.6805	5	4	80	Pass
111.6011	5	3	60	Pass
112.5218	5	3	60	Pass
113.4424	5	3	60	Pass
114.3631	4	3	75	Pass
115.2837	4	3	75	Pass
116.2044	4	3	75	Pass
117.1250	4	3	75	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.738 acre-feet
On-line facility target flow:	0.8012 cfs.
Adjusted for 15 min:	0.8012 cfs.
Off-line facility target flow:	0.3651 cfs.
Adjusted for 15 min:	0.3651 cfs.

Wetland Input Volumes



Wetlands Input Volume for POC 1
Average Annual Volume (acft)
Series 1: 501 POC 1 Predeveloped flow
Series 2: 801 POC 1 Mitigated flow

Month	**Series 1**	**Series 2**	**Percent**	**Pass/Fail**
Jan	97.8912	91.1251	93.1	Pass
Feb	73.5771	68.2699	92.8	Pass
Mar	57.4849	53.5281	93.1	Pass
Apr	30.9501	28.9810	93.6	Pass
May	18.5413	17.5822	94.8	Pass
Jun	10.1964	9.7595	95.7	Pass
Jul	4.3738	4.1869	95.7	Pass
Aug	1.9351	1.8506	95.6	Pass
Sep	1.0843	1.0854	100.1	Pass
Oct	4.4770	4.6441	103.7	Pass
Nov	37.8162	37.0595	98.0	Pass
Dec	83.7167	78.9213	94.3	Pass

Day	**Predevel**	**Mitigated**	**Percent**	**Pass/Fail**
Jan1	2.8815	2.6954	93.5	Pass
2	2.9102	2.7120	93.2	Pass
3	3.2761	3.0479	93.0	Pass
4	2.6871	2.4983	93.0	Pass
5	3.0913	2.9011	93.8	Pass
6	3.1087	2.9024	93.4	Pass
7	2.9136	2.7185	93.3	Pass
8	2.9989	2.7950	93.2	Pass
9	3.6315	3.3863	93.2	Pass
10	3.0139	2.8028	93.0	Pass
11	3.0535	2.8651	93.8	Pass
12	3.2415	3.0102	92.9	Pass
13	3.7536	3.5110	93.5	Pass
14	3.8561	3.5796	92.8	Pass

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15	3.5627	3.3369	93.7	Pass
16	3.6286	3.3761	93.0	Pass
17	3.4601	3.2133	92.9	Pass
18	3.6398	3.3907	93.2	Pass
19	3.6796	3.4013	92.4	Pass
20	2.7196	2.5011	92.0	Pass
21	3.1433	2.9163	92.8	Pass
22	3.1616	2.9504	93.3	Pass
23	2.9343	2.7175	92.6	Pass
24	3.2287	3.0069	93.1	Pass
25	2.9471	2.7164	92.2	Pass
26	3.0336	2.8174	92.9	Pass
27	2.7184	2.5202	92.7	Pass
28	2.5664	2.3767	92.6	Pass
29	2.7498	2.5626	93.2	Pass
30	3.7653	3.5335	93.8	Pass
31	3.1006	2.8532	92.0	Pass
Feb1	2.7831	2.5785	92.6	Pass
2	2.4520	2.2552	92.0	Pass
3	2.0970	1.9346	92.3	Pass
4	1.9333	1.8018	93.2	Pass
5	2.7686	2.5981	93.8	Pass
6	3.0456	2.8208	92.6	Pass
7	3.0038	2.7826	92.6	Pass
8	2.7341	2.5372	92.8	Pass
9	2.6738	2.4744	92.5	Pass
10	2.2437	2.0729	92.4	Pass
11	2.3779	2.2199	93.4	Pass
12	2.4184	2.2485	93.0	Pass
13	2.1652	2.0008	92.4	Pass
14	2.1460	2.0014	93.3	Pass
15	2.6330	2.4482	93.0	Pass
16	2.7127	2.5394	93.6	Pass
17	3.2562	3.0493	93.6	Pass
18	2.9141	2.6927	92.4	Pass
19	3.3024	3.0684	92.9	Pass
20	2.6956	2.5047	92.9	Pass
21	2.5054	2.3298	93.0	Pass
22	2.7939	2.5933	92.8	Pass
23	2.8015	2.6011	92.8	Pass
24	2.4892	2.2877	91.9	Pass
25	2.2099	2.0439	92.5	Pass
26	2.6608	2.4738	93.0	Pass
27	2.1742	2.0103	92.5	Pass
28	1.8158	1.6767	92.3	Pass
29	2.0834	1.9435	93.3	Pass
Mar1	1.9282	1.7874	92.7	Pass
2	2.1195	1.9843	93.6	Pass
3	2.1407	1.9929	93.1	Pass
4	2.1242	1.9784	93.1	Pass
5	1.9298	1.7943	93.0	Pass
6	1.9833	1.8483	93.2	Pass
7	2.0869	1.9589	93.9	Pass
8	2.4644	2.2934	93.1	Pass
9	2.0263	1.8717	92.4	Pass
10	2.2636	2.1137	93.4	Pass
11	2.3151	2.1505	92.9	Pass
12	2.2056	2.0469	92.8	Pass

13	2.1287	1.9693	92.5	Pass
14	2.0379	1.8854	92.5	Pass
15	1.8560	1.7272	93.1	Pass
16	1.5914	1.4770	92.8	Pass
17	1.5849	1.4825	93.5	Pass
18	1.4747	1.3690	92.8	Pass
19	1.5055	1.4006	93.0	Pass
20	1.3709	1.2719	92.8	Pass
21	1.4749	1.3798	93.6	Pass
22	1.6136	1.5147	93.9	Pass
23	1.6927	1.5909	94.0	Pass
24	1.8949	1.7724	93.5	Pass
25	1.5935	1.4780	92.8	Pass
26	1.6354	1.5290	93.5	Pass
27	1.5995	1.4872	93.0	Pass
28	1.7411	1.6310	93.7	Pass
29	1.5951	1.4814	92.9	Pass
30	1.4241	1.3170	92.5	Pass
31	1.2304	1.1413	92.8	Pass
Apr1	1.1103	1.0327	93.0	Pass
2	1.0533	0.9844	93.5	Pass
3	0.9762	0.9105	93.3	Pass
4	1.1365	1.0659	93.8	Pass
5	1.0516	0.9777	93.0	Pass
6	1.1797	1.1037	93.6	Pass
7	1.2071	1.1356	94.1	Pass
8	1.3270	1.2418	93.6	Pass
9	1.1371	1.0550	92.8	Pass
10	1.0738	0.9984	93.0	Pass
11	1.2958	1.2238	94.4	Pass
12	1.2582	1.1760	93.5	Pass
13	1.0816	1.0087	93.3	Pass
14	1.0088	0.9409	93.3	Pass
15	0.9564	0.8943	93.5	Pass
16	0.9488	0.8863	93.4	Pass
17	0.8793	0.8226	93.6	Pass
18	0.9493	0.9006	94.9	Pass
19	0.9959	0.9372	94.1	Pass
20	1.0384	0.9765	94.0	Pass
21	1.1401	1.0807	94.8	Pass
22	1.1161	1.0404	93.2	Pass
23	1.0144	0.9446	93.1	Pass
24	0.9001	0.8455	93.9	Pass
25	0.8205	0.7665	93.4	Pass
26	0.8952	0.8473	94.6	Pass
27	0.7647	0.7179	93.9	Pass
28	0.7313	0.6913	94.5	Pass
29	0.6718	0.6327	94.2	Pass
30	0.6389	0.6070	95.0	Pass
May1	0.6461	0.6145	95.1	Pass
2	0.6327	0.5993	94.7	Pass
3	0.6084	0.5745	94.4	Pass
4	0.6679	0.6394	95.7	Pass
5	0.7251	0.6845	94.4	Pass
6	0.6959	0.6517	93.6	Pass
7	0.6181	0.5824	94.2	Pass
8	0.5604	0.5302	94.6	Pass
9	0.6012	0.5692	94.7	Pass

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10	0.5618	0.5281	94.0	Pass
11	0.5189	0.4878	94.0	Pass
12	0.5089	0.4836	95.0	Pass
13	0.5415	0.5172	95.5	Pass
14	0.5691	0.5389	94.7	Pass
15	0.5142	0.4857	94.5	Pass
16	0.8018	0.7744	96.6	Pass
17	0.7000	0.6622	94.6	Pass
18	0.6339	0.6024	95.0	Pass
19	0.6742	0.6361	94.3	Pass
20	0.6308	0.5919	93.8	Pass
21	0.6000	0.5678	94.6	Pass
22	0.5563	0.5275	94.8	Pass
23	0.5791	0.5542	95.7	Pass
24	0.5914	0.5674	95.9	Pass
25	0.6179	0.5850	94.7	Pass
26	0.5384	0.5067	94.1	Pass
27	0.4755	0.4498	94.6	Pass
28	0.4437	0.4215	95.0	Pass
29	0.3900	0.3695	94.7	Pass
30	0.6991	0.6717	96.1	Pass
31	0.4895	0.4618	94.3	Pass
Jun1	0.4465	0.4201	94.1	Pass
2	0.4755	0.4565	96.0	Pass
3	0.4654	0.4455	95.7	Pass
4	0.4049	0.3831	94.6	Pass
5	0.5631	0.5520	98.0	Pass
6	0.4931	0.4712	95.6	Pass
7	0.4812	0.4607	95.7	Pass
8	0.4380	0.4203	96.0	Pass
9	0.4065	0.3880	95.4	Pass
10	0.3626	0.3470	95.7	Pass
11	0.3212	0.3065	95.4	Pass
12	0.3091	0.2966	95.9	Pass
13	0.3036	0.2911	95.9	Pass
14	0.2907	0.2775	95.5	Pass
15	0.2751	0.2624	95.4	Pass
16	0.2624	0.2498	95.2	Pass
17	0.2671	0.2566	96.1	Pass
18	0.2734	0.2609	95.4	Pass
19	0.3197	0.3146	98.4	Pass
20	0.3721	0.3576	96.1	Pass
21	0.3235	0.3067	94.8	Pass
22	0.2772	0.2626	94.7	Pass
23	0.2487	0.2354	94.7	Pass
24	0.2350	0.2244	95.5	Pass
25	0.2254	0.2165	96.1	Pass
26	0.2234	0.2164	96.9	Pass
27	0.2203	0.2126	96.5	Pass
28	0.2151	0.2067	96.1	Pass
29	0.2071	0.1986	95.9	Pass
30	0.2011	0.1926	95.8	Pass
Jul1	0.1928	0.1840	95.4	Pass
2	0.1861	0.1773	95.3	Pass
3	0.1802	0.1715	95.2	Pass
4	0.1754	0.1670	95.2	Pass
5	0.1707	0.1625	95.2	Pass
6	0.1664	0.1584	95.2	Pass

7	0.1638	0.1562	95.4	Pass
8	0.1659	0.1608	96.9	Pass
9	0.1637	0.1576	96.3	Pass
10	0.1575	0.1508	95.8	Pass
11	0.1514	0.1446	95.5	Pass
12	0.1462	0.1394	95.4	Pass
13	0.1417	0.1351	95.3	Pass
14	0.1380	0.1316	95.3	Pass
15	0.1376	0.1321	96.1	Pass
16	0.1360	0.1305	95.9	Pass
17	0.1316	0.1259	95.7	Pass
18	0.1324	0.1288	97.2	Pass
19	0.1311	0.1275	97.3	Pass
20	0.1358	0.1315	96.9	Pass
21	0.1297	0.1254	96.7	Pass
22	0.1215	0.1165	95.9	Pass
23	0.1148	0.1097	95.6	Pass
24	0.1098	0.1048	95.4	Pass
25	0.1061	0.1012	95.4	Pass
26	0.1027	0.0979	95.3	Pass
27	0.0997	0.0950	95.3	Pass
28	0.0973	0.0927	95.4	Pass
29	0.0947	0.0904	95.4	Pass
30	0.0920	0.0877	95.3	Pass
31	0.0893	0.0850	95.2	Pass
Aug1	0.0867	0.0826	95.2	Pass
2	0.0843	0.0803	95.2	Pass
3	0.0820	0.0780	95.2	Pass
4	0.0796	0.0758	95.1	Pass
5	0.0775	0.0737	95.1	Pass
6	0.0756	0.0720	95.2	Pass
7	0.0738	0.0703	95.2	Pass
8	0.0716	0.0681	95.2	Pass
9	0.0694	0.0660	95.1	Pass
10	0.0674	0.0641	95.1	Pass
11	0.0654	0.0622	95.1	Pass
12	0.0636	0.0605	95.1	Pass
13	0.0617	0.0587	95.1	Pass
14	0.0606	0.0577	95.2	Pass
15	0.0592	0.0564	95.2	Pass
16	0.0573	0.0546	95.2	Pass
17	0.0555	0.0528	95.1	Pass
18	0.0541	0.0515	95.1	Pass
19	0.0537	0.0512	95.3	Pass
20	0.0520	0.0495	95.3	Pass
21	0.0502	0.0479	95.3	Pass
22	0.0504	0.0483	95.9	Pass
23	0.0512	0.0495	96.7	Pass
24	0.0537	0.0533	99.2	Pass
25	0.0553	0.0543	98.3	Pass
26	0.0521	0.0507	97.3	Pass
27	0.0484	0.0468	96.7	Pass
28	0.0459	0.0443	96.7	Pass
29	0.0446	0.0431	96.7	Pass
30	0.0430	0.0416	96.6	Pass
31	0.0427	0.0412	96.6	Pass
Sep1	0.0416	0.0402	96.6	Pass
2	0.0403	0.0389	96.6	Pass

3	0.0397	0.0387	97.3	Pass
4	0.0389	0.0379	97.3	Pass
5	0.0376	0.0365	97.0	Pass
6	0.0364	0.0352	96.9	Pass
7	0.0353	0.0342	96.8	Pass
8	0.0347	0.0337	97.0	Pass
9	0.0343	0.0333	97.1	Pass
10	0.0338	0.0328	97.1	Pass
11	0.0328	0.0318	97.0	Pass
12	0.0320	0.0311	97.1	Pass
13	0.0317	0.0308	97.2	Pass
14	0.0327	0.0319	97.5	Pass
15	0.0321	0.0313	97.6	Pass
16	0.0315	0.0307	97.5	Pass
17	0.0388	0.0438	112.9	Pass
18	0.0396	0.0420	106.2	Pass
19	0.0425	0.0454	106.6	Pass
20	0.0439	0.0454	103.6	Pass
21	0.0393	0.0399	101.6	Pass
22	0.0359	0.0361	100.5	Pass
23	0.0340	0.0339	99.9	Pass
24	0.0347	0.0362	104.5	Pass
25	0.0355	0.0367	103.5	Pass
26	0.0334	0.0338	101.2	Pass
27	0.0317	0.0319	100.8	Pass
28	0.0333	0.0350	105.1	Pass
29	0.0336	0.0350	104.0	Pass
30	0.0375	0.0373	99.6	Pass
Oct1	0.0369	0.0364	98.7	Pass
2	0.0369	0.0367	99.2	Pass
3	0.0378	0.0378	100.0	Pass
4	0.0424	0.0430	101.5	Pass
5	0.0441	0.0443	100.6	Pass
6	0.0446	0.0458	102.6	Pass
7	0.0519	0.0563	108.5	Pass
8	0.0890	0.1058	118.8	Pass
9	0.1135	0.1212	106.8	Pass
10	0.1176	0.1295	110.2	Pass
11	0.1279	0.1373	107.3	Pass
12	0.1145	0.1179	103.0	Pass
13	0.0972	0.1000	102.8	Pass
14	0.0865	0.0882	102.0	Pass
15	0.0731	0.0740	101.2	Pass
16	0.0700	0.0711	101.5	Pass
17	0.0787	0.0807	102.5	Pass
18	0.0753	0.0777	103.2	Pass
19	0.0929	0.0954	102.6	Pass
20	0.1266	0.1374	108.6	Pass
21	0.2636	0.2687	101.9	Pass
22	0.2790	0.2708	97.1	Pass
23	0.2064	0.2032	98.5	Pass
24	0.1831	0.1884	102.9	Pass
25	0.1611	0.1661	103.1	Pass
26	0.2015	0.2246	111.4	Pass
27	0.2707	0.2944	108.7	Pass
28	0.4069	0.4236	104.1	Pass
29	0.4063	0.4189	103.1	Pass
30	0.5035	0.5119	101.7	Pass

31	0.4699	0.4635	98.6	Pass
Nov1	0.5299	0.5311	100.2	Pass
2	0.4232	0.4287	101.3	Pass
3	0.5163	0.5484	106.2	Pass
4	0.4342	0.4264	98.2	Pass
5	0.4655	0.4919	105.7	Pass
6	0.5363	0.5370	100.1	Pass
7	0.6859	0.7038	102.6	Pass
8	0.7682	0.7592	98.8	Pass
9	0.7194	0.7209	100.2	Pass
10	1.1935	1.1952	100.1	Pass
11	0.9104	0.8872	97.5	Pass
12	0.8976	0.8953	99.7	Pass
13	0.9102	0.9078	99.7	Pass
14	1.5473	1.5151	97.9	Pass
15	1.1110	1.0837	97.5	Pass
16	1.0598	1.0544	99.5	Pass
17	1.2940	1.2974	100.3	Pass
18	1.8702	1.8301	97.9	Pass
19	1.5883	1.5644	98.5	Pass
20	1.5486	1.5341	99.1	Pass
21	1.5934	1.5585	97.8	Pass
22	1.8321	1.8082	98.7	Pass
23	2.4125	2.3499	97.4	Pass
24	2.5169	2.4283	96.5	Pass
25	2.2829	2.1812	95.5	Pass
26	2.1149	2.0345	96.2	Pass
27	1.9230	1.8189	94.6	Pass
28	1.6155	1.5339	94.9	Pass
29	2.0507	1.9751	96.3	Pass
30	1.7972	1.7090	95.1	Pass
Dec1	2.6008	2.5140	96.7	Pass
2	2.6925	2.5855	96.0	Pass
3	2.8982	2.7577	95.1	Pass
4	2.4554	2.3323	95.0	Pass
5	2.6218	2.4890	94.9	Pass
6	2.4130	2.2828	94.6	Pass
7	2.1000	1.9857	94.6	Pass
8	2.0366	1.9411	95.3	Pass
9	2.5362	2.4267	95.7	Pass
10	2.5179	2.3979	95.2	Pass
11	2.5873	2.4381	94.2	Pass
12	3.0131	2.8482	94.5	Pass
13	2.6645	2.4941	93.6	Pass
14	2.6979	2.5350	94.0	Pass
15	2.5904	2.4495	94.6	Pass
16	2.2658	2.1149	93.3	Pass
17	2.0355	1.9065	93.7	Pass
18	2.3133	2.1970	95.0	Pass
19	2.7339	2.5685	93.9	Pass
20	3.6809	3.4694	94.3	Pass
21	3.1463	2.9496	93.7	Pass
22	2.9367	2.7557	93.8	Pass
23	3.0210	2.8293	93.7	Pass
24	3.0203	2.8112	93.1	Pass
25	3.0608	2.8716	93.8	Pass
26	3.2525	3.0408	93.5	Pass
27	2.9085	2.7062	93.0	Pass

28	3.1116	2.9102	93.5	Pass
29	3.0420	2.8444	93.5	Pass
30	2.9632	2.7574	93.1	Pass
31	2.5365	2.3636	93.2	Pass

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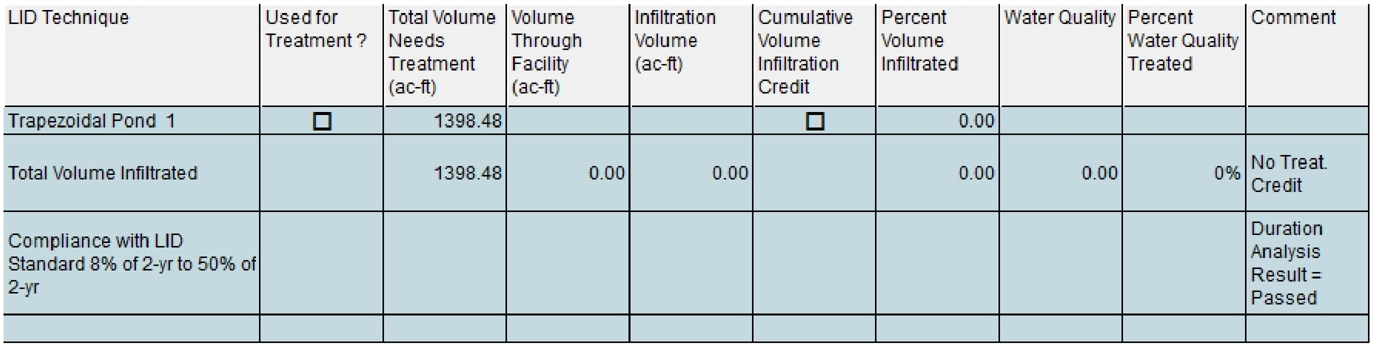
LID Report



LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Trapezoidal Pond 1	☐	1398.48			☐	0.00			
Total Volume Infiltrated		1398.48	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

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Appendix

Predeveloped Schematic

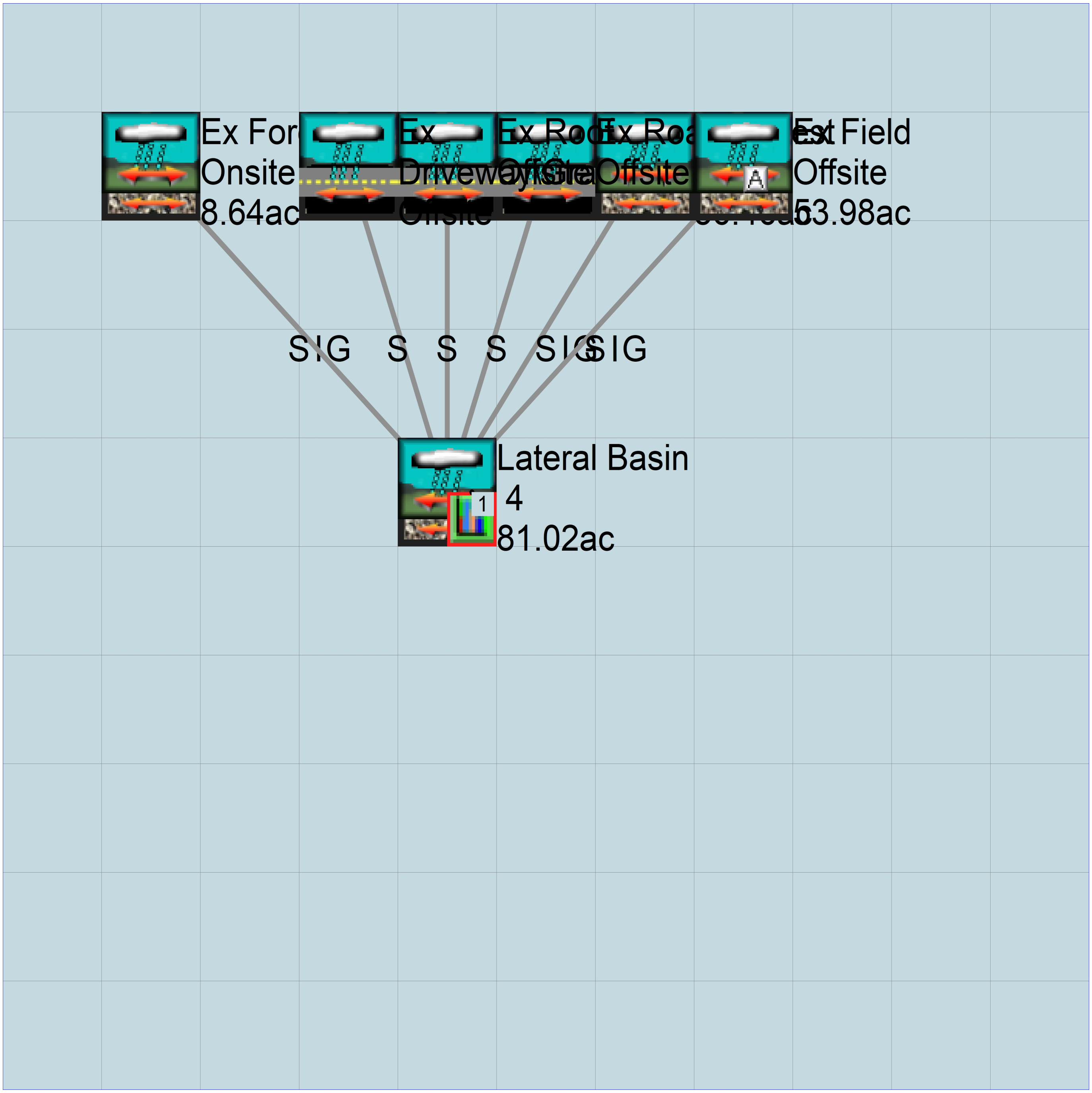
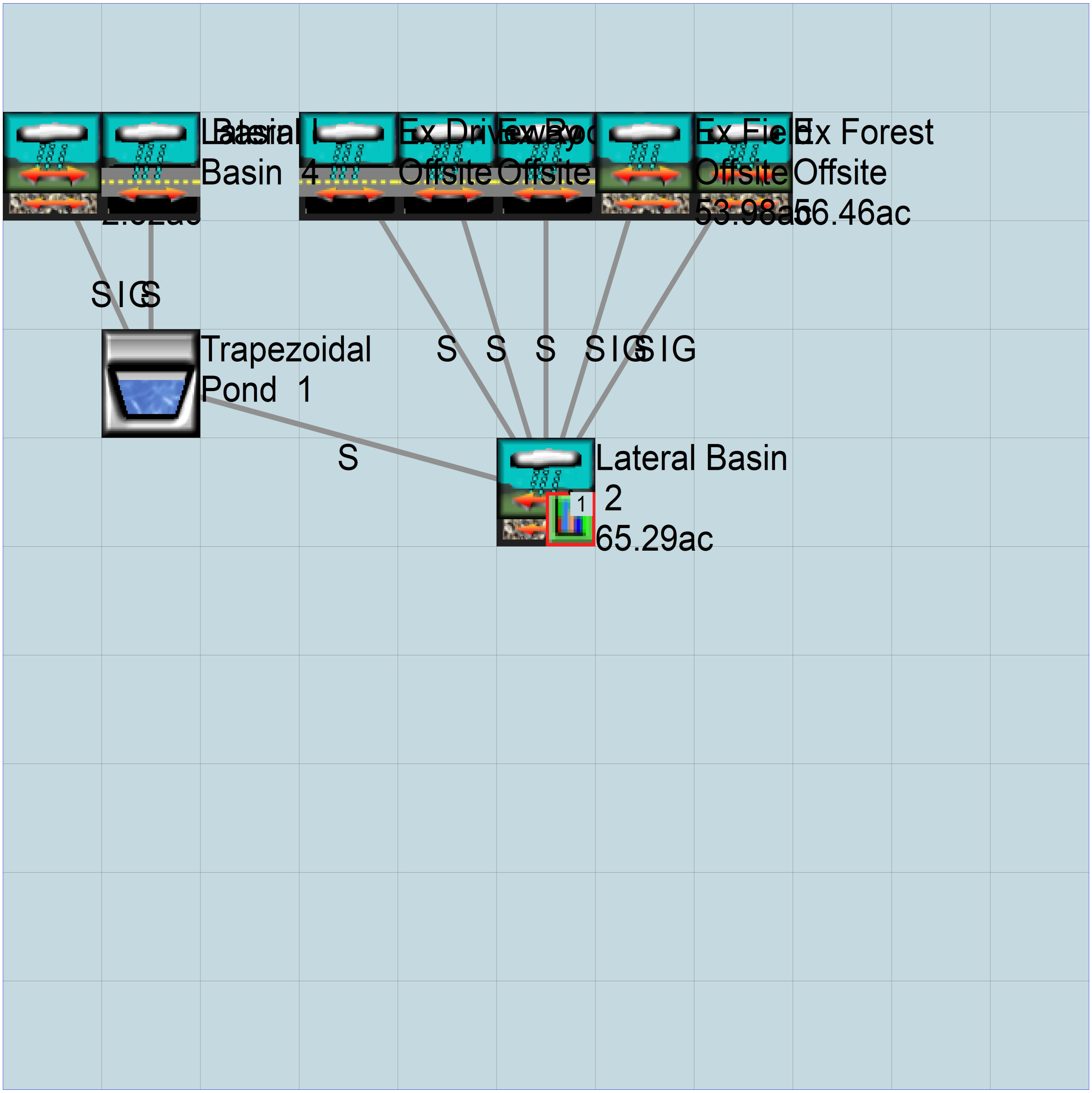


Exhibit 21 SUB25-1004

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Hydropperiod Protection Detention Pond.wdm
MESSU      25   PreHydropperiod Protection Detention Pond.MES
           27   PreHydropperiod Protection Detention Pond.L61
           28   PreHydropperiod Protection Detention Pond.L62
           30   POCHydropperiod Protection Detention Pond1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      48
      IMPLND      17
      PERLND      49
      IMPLND      18
      IMPLND      19
      PERLND      52
      PERLND      56
      COPY       501
      COPY         1
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Lateral Basin  4            MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                         in  out           ***
   48      SG4, Forest, Mod        1    1    1    1   27    0
   49      SG4, Forest, Mod        1    1    1    1   27    0
   52      SG4, Field, Flat        1    1    1    1   27    0
   56      SG4, Forest, Mod        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
```

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```
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   48         0    0    1    0    0    0    0    0    0    0    0    0
   49         0    0    1    0    0    0    0    0    0    0    0    0
   52         0    0    1    0    0    0    0    0    0    0    0    0
   56         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   48         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   49         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   52         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   56         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   48         0    0    0    0    0    0    0    0    0    0    0
   49         0    0    0    0    0    0    0    0    0    0    0
   52         0    0    0    0    0    0    0    0    0    0    0
   56         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   48             0         6      0.04       400       0.1         0      0.96
   49             0         6      0.04       400       0.1         0      0.96
   52             0         6      0.03       400      0.05         0      0.96
   56             0         6      0.04       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   48             0         0         3         2         0         0         0
   49             0         0         3         2         0         0         0
   52             0         0         3         2         0         0         0
   56             0         0         3         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   48           0.2       0.4      0.35         2       0.4       0.7
   49           0.2       0.4      0.35         2       0.4       0.7
   52          0.15       0.4       0.3         2       0.4       0.4
   56           0.2       0.4      0.35         2       0.4       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   48             0         0         0         0       2.5         1         0
   49             0         0         0         0       2.5         1         0
   52             0         0         0         0       2.5         1         0
   56             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
   17      ROADS/FLAT             1    1    1   27    0
   18      ROOF TOPS/FLAT         1    1    1   27    0
```

```
   19      DRIVEWAYS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   17         0    0    1    0    0    0
   18         0    0    1    0    0    0
   19         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   17         0    0    4    0    0    0    1    9
   18         0    0    4    0    0    0    1    9
   19         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   17         0    0    0    0    0
   18         0    0    0    0    0
   19         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   17            400      0.01       0.1       0.1
   18            400      0.01       0.1       0.1
   19            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   17              0         0
   18              0         0
   19              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   17              0         0
   18              0         0
   19              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                   <--Area-->     <-Target->   MBLK   ***
<Name>   #                   <-factor->     <Name>   #   Tbl#   ***
Ex Forest Offsite***
PERLND  48                       0.6969     PERLND  56     30
PERLND  48                       0.6969     PERLND  56     34
PERLND  48                       0.6969     PERLND  56     38
Ex Roads Offsite***
IMPLND  17                       0.0147     PERLND  56     50
Ex Forest Onsite***
PERLND  49                       0.1066     PERLND  56     30
PERLND  49                       0.1066     PERLND  56     34
PERLND  49                       0.1066     PERLND  56     38
Ex Roof Offsite***
IMPLND  18                       0.0288     PERLND  56     50
Ex Driveway\\Gravel Offsite***
```

```
IMPLND  19                      0.0398     PERLND  56     50
Ex Field Offsite***
PERLND  52                      0.6662     PERLND  56     30
PERLND  52                      0.6662     PERLND  56     34
PERLND  52                      0.6662     PERLND  56     38
Lateral Basin  4***
PERLND  56                     81.0229     COPY   501     12
PERLND  56                     81.0229     COPY   501     13
PERLND  56                     81.0229     COPY   501     14

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
```

```
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     0 OUTPUT MEAN     1     48.4      WDM   1000 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       14
PERLND     PWATER AGWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   14

  MASS-LINK       30
PERLND     PWATER SURO                     PERLND         EXTNL  SURLI
  END MASS-LINK   30

  MASS-LINK       34
PERLND     PWATER IFWO                     PERLND         EXTNL  IFWLI
  END MASS-LINK   34

  MASS-LINK       38
PERLND     PWATER AGWO                     PERLND         EXTNL  AGWLI
  END MASS-LINK   38

  MASS-LINK       50
IMPLND     IWATER SURO                     PERLND         EXTNL  SURLI
  END MASS-LINK   50


END MASS-LINK

END RUN
```

Exhibit 21 SUB25-1004

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   Hydropperiod Protection Detention Pond.wdm
MESSU      25   MitHydropperiod Protection Detention Pond.MES
           27   MitHydropperiod Protection Detention Pond.L61
           28   MitHydropperiod Protection Detention Pond.L62
           30   POCHydropperiod Protection Detention Pond1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND      16
      PERLND      47
      IMPLND      20
      IMPLND      21
      PERLND      53
      PERLND      55
      IMPLND      22
      RCHRES       1
      PERLND      50
      COPY       501
      COPY         1
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Lateral Basin  2           MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                            in  out           ***
   47     SG4, Forest, Mod        1    1    1    1   27    0
   53     SG4, Field, Flat        1    1    1    1   27    0
   55     SG3, Lawn, Flat         1    1    1    1   27    0
   50     SG4, Forest, Mod        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***
```

Exhibit 21 SUB25-1004

```
  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   47         0    0    1    0    0    0    0    0    0    0    0    0
   53         0    0    1    0    0    0    0    0    0    0    0    0
   55         0    0    1    0    0    0    0    0    0    0    0    0
   50         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   47         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   53         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   55         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   50         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   47         0    0    0    0    0    0    0    0    0    0    0
   53         0    0    0    0    0    0    0    0    0    0    0
   55         0    0    0    0    0    0    0    0    0    0    0
   50         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   47              0         6      0.04       400       0.1         0      0.96
   53              0         6      0.03       400      0.05         0      0.96
   55              0         9      0.05       400      0.05         0      0.96
   50              0         6      0.04       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   47              0         0         3         2         0         0         0
   53              0         0         3         2         0         0         0
   55              0         0       2.5         2         0         0         0
   50              0         0         3         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   47            0.2       0.4      0.35         2       0.4       0.7
   53           0.15       0.4       0.3         2       0.4       0.4
   55            0.1       0.8      0.25         4       0.4      0.25
   50            0.2       0.4      0.35         2       0.4       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   47              0         0         0         0       2.5         1         0
   53              0         0         0         0       2.5         1         0
   55              0         0         0         0         3         1         0
   50              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
```

```
   16      ROADS/FLAT             1    1    1   27    0
   20      ROOF TOPS/FLAT         1    1    1   27    0
   21      DRIVEWAYS/FLAT         1    1    1   27    0
   22      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   16         0    0    1    0    0    0
   20         0    0    1    0    0    0
   21         0    0    1    0    0    0
   22         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   16         0    0    4    0    0    0    1    9
   20         0    0    4    0    0    0    1    9
   21         0    0    4    0    0    0    1    9
   22         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   16         0    0    0    0    0
   20         0    0    0    0    0
   21         0    0    0    0    0
   22         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   16            400      0.01       0.1       0.1
   20            400      0.01       0.1       0.1
   21            400      0.01       0.1       0.1
   22            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   16              0         0
   20              0         0
   21              0         0
   22              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   16              0         0
   20              0         0
   21              0         0
   22              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Ex Roads Offsite***
IMPLND  16                      0.0183     PERLND  50     50
Ex Forest Offsite***
PERLND  47                      0.8648     PERLND  50     30
```

```
PERLND  47                      0.8648     PERLND  50     34
PERLND  47                      0.8648     PERLND  50     38
Ex Roof Offsite***
IMPLND  20                      0.0357     PERLND  50     50
Ex Driveway Offsite***
IMPLND  21                      0.0494     PERLND  50     50
Ex Field Offsite***
PERLND  53                      0.8267     PERLND  50     30
PERLND  53                      0.8267     PERLND  50     34
PERLND  53                      0.8267     PERLND  50     38
Lateral Basin  4***
PERLND  55                      2.5194     RCHRES   1      2
PERLND  55                      2.5194     RCHRES   1      3
PERLND  55                      2.5194     RCHRES   1      4
Lateral I Basin  4***
IMPLND  22                      6.1183     RCHRES   1      5
Lateral Basin  2***
PERLND  50                     65.2919     COPY   501     12
PERLND  50                     65.2919     COPY   501     13
PERLND  50                     65.2919     COPY   501     14

******Routing******
IMPLND  16                      1.1934     COPY     1     15
PERLND  47                     56.4623     COPY     1     12
PERLND  47                     56.4623     COPY     1     13
PERLND  47                     56.4623     COPY     1     14
IMPLND  20                      2.3306     COPY     1     15
IMPLND  21                      3.2286     COPY     1     15
PERLND  53                     53.9768     COPY     1     12
PERLND  53                     53.9768     COPY     1     13
PERLND  53                     53.9768     COPY     1     14
RCHRES   1                       .0153     PERLND  50     60
RCHRES   1                                 COPY     1     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
    1     Trapezoidal Pond-023    1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
```

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```
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.069559  0.000000  0.000000
  0.055556  0.070559  0.003892  0.129523
  0.111111  0.071564  0.007840  0.183173
  0.166667  0.072573  0.011844  0.224341
  0.222222  0.073588  0.015904  0.259046
  0.277778  0.074608  0.020020  0.289623
  0.333333  0.075634  0.024194  0.317266
  0.388889  0.076664  0.028424  0.342686
  0.444444  0.077699  0.032712  0.366347
  0.500000  0.078740  0.037058  0.388570
  0.555556  0.079785  0.041461  0.409588
  0.611111  0.080836  0.045923  0.429580
  0.666667  0.081892  0.050443  0.448681
  0.722222  0.082953  0.055022  0.467002
  0.777778  0.084018  0.059660  0.484631
  0.833333  0.085090  0.064358  0.501641
  0.888889  0.086166  0.069115  0.518093
  0.944444  0.087247  0.073932  0.534038
  1.000000  0.088333  0.078809  0.549520
  1.055556  0.089425  0.083747  0.564578
  1.111111  0.090521  0.088745  0.579245
  1.166667  0.091623  0.093805  0.593550
  1.222222  0.092730  0.098926  0.607518
  1.277778  0.093842  0.104108  0.621171
  1.333333  0.094959  0.109353  0.634531
  1.388889  0.096081  0.114659  0.647616
  1.444444  0.097208  0.120028  0.660441
  1.500000  0.098340  0.125460  0.673022
  1.555556  0.099478  0.130955  0.685372
  1.611111  0.100620  0.136514  0.697504
  1.666667  0.101768  0.142135  0.709428
  1.722222  0.102920  0.147821  0.721155
  1.777778  0.104078  0.153571  0.732694
  1.833333  0.105241  0.159386  0.744054
  1.888889  0.106409  0.165265  0.755243
  1.944444  0.107582  0.171209  0.766269
  2.000000  0.108760  0.177218  0.777139
  2.055556  0.109944  0.183294  0.787859
  2.111111  0.111132  0.189435  0.798435
  2.166667  0.112326  0.195642  0.808872
  2.222222  0.113524  0.201915  0.819177
  2.277778  0.114728  0.208256  0.829353
  2.333333  0.115937  0.214663  0.839406
  2.388889  0.117151  0.221138  0.849340
```

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```
  2.444444  0.118370  0.227680  0.859160
  2.500000  0.119594  0.234290  0.868868
  2.555556  0.120823  0.240968  0.878469
  2.611111  0.122057  0.247715  0.887966
  2.666667  0.123297  0.254530  0.897363
  2.722222  0.124541  0.261415  0.906662
  2.777778  0.125791  0.268368  0.931284
  2.833333  0.127045  0.275392  1.005088
  2.888889  0.128305  0.282485  1.106369
  2.944444  0.129570  0.289648  1.228464
  3.000000  0.130840  0.296881  1.368047
  3.055556  0.132115  0.304186  1.523014
  3.111111  0.133396  0.311561  1.691875
  3.166667  0.134681  0.319008  1.873506
  3.222222  0.135971  0.326526  2.067016
  3.277778  0.137267  0.334116  2.271681
  3.333333  0.138567  0.341778  2.486891
  3.388889  0.139873  0.349512  2.712130
  3.444444  0.141184  0.357319  2.946950
  3.500000  0.142500  0.365199  3.190957
  3.555556  0.143821  0.373153  3.443803
  3.611111  0.145147  0.381180  3.705177
  3.666667  0.146478  0.389280  3.974798
  3.722222  0.147815  0.397455  4.252411
  3.777778  0.149156  0.405704  4.537785
  3.833333  0.150503  0.414028  4.830705
  3.888889  0.151854  0.422427  5.130977
  3.944444  0.153211  0.430901  5.438417
  4.000000  0.154573  0.439451  5.752857
  4.055556  0.155940  0.448076  5.968734
  4.111111  0.157312  0.456778  6.355822
  4.166667  0.158689  0.465555  6.849790
  4.222222  0.160071  0.474410  7.419918
  4.277778  0.161459  0.483341  8.039214
  4.333333  0.162851  0.492350  8.680254
  4.388889  0.164249  0.501436  9.314964
  4.444444  0.165651  0.510600  9.915940
  4.500000  0.167059  0.519842  10.45862
  4.555556  0.168472  0.529162  10.92405
  4.611111  0.169890  0.538561  11.30217
  4.666667  0.171313  0.548039  11.59541
  4.722222  0.172741  0.557596  11.82272
  4.777778  0.174175  0.567233  12.10482
  4.833333  0.175613  0.576949  12.33114
  4.888889  0.177056  0.586745  12.55023
  4.944444  0.178505  0.596622  12.76274
  5.000000  0.179959  0.606579  12.96925
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
```

```
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        4
PERLND     PWATER AGWO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    4

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       14
PERLND     PWATER AGWO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   14

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY            INPUT  MEAN
  END MASS-LINK   16

  MASS-LINK       30
PERLND     PWATER SURO                     PERLND          EXTNL  SURLI
  END MASS-LINK   30

  MASS-LINK       34
PERLND     PWATER IFWO                     PERLND          EXTNL  IFWLI
  END MASS-LINK   34

  MASS-LINK       38
PERLND     PWATER AGWO                     PERLND          EXTNL  AGWLI
  END MASS-LINK   38

  MASS-LINK       50
IMPLND     IWATER SURO                     PERLND          EXTNL  SURLI
  END MASS-LINK   50

  MASS-LINK       60
RCHRES     ROFLOW            12.00000      PERLND          EXTNL  SURLI
  END MASS-LINK   60

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

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Mitigated HSPF Message File

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Olympia, WA. 98501
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Local (360)943-0304

www.clearcreeksolutions.com

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: Basin 1

Site Name:

Site Address:

City:

Report Date:	5/12/2025
Gage:	Lacamas
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	1.300
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG4, Forest, Mod	8.6377
Pervious Total	8.6377
Impervious Land Use	acre
Impervious Total	0
Basin Total	8.6377

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
SG3, Lawn, Flat	2.5194
Pervious Total	2.5194
Impervious Land Use	acre
ROADS FLAT	1.342
ROOF TOPS FLAT	4.0645
DRIVEWAYS FLAT	0.3809
SIDEWALKS FLAT	0.3309
Impervious Total	6.1183
Basin Total	8.6377

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Routing Elements

Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length:	100.00 ft.
Bottom Width:	30.30 ft.
Depth:	5 ft.
Volume at riser head:	0.4481 acre-feet.
Side slope 1:	3 To 1
Side slope 2:	3 To 1
Side slope 3:	3 To 1
Side slope 4:	3 To 1
Discharge Structure	
Riser Height:	4 ft.
Riser Diameter:	18 in.
Notch Type:	Rectangular
Notch Width:	1.000 ft.
Notch Height:	1.250 ft.
Orifice 1 Diameter:	4.500 in. Elevation:0 ft.
Element Flows To:	
Outlet 1	Outlet 2

Pond Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.069	0.000	0.000	0.000
0.0556	0.070	0.003	0.129	0.000
0.1111	0.071	0.007	0.183	0.000
0.1667	0.072	0.011	0.224	0.000
0.2222	0.073	0.015	0.259	0.000
0.2778	0.074	0.020	0.289	0.000
0.3333	0.075	0.024	0.317	0.000
0.3889	0.076	0.028	0.342	0.000
0.4444	0.077	0.032	0.366	0.000
0.5000	0.078	0.037	0.388	0.000
0.5556	0.079	0.041	0.409	0.000
0.6111	0.080	0.045	0.429	0.000
0.6667	0.081	0.050	0.448	0.000
0.7222	0.083	0.055	0.467	0.000
0.7778	0.084	0.059	0.484	0.000
0.8333	0.085	0.064	0.501	0.000
0.8889	0.086	0.069	0.518	0.000
0.9444	0.087	0.073	0.534	0.000
1.0000	0.088	0.078	0.549	0.000
1.0556	0.089	0.083	0.564	0.000
1.1111	0.090	0.088	0.579	0.000
1.1667	0.091	0.093	0.593	0.000
1.2222	0.092	0.098	0.607	0.000
1.2778	0.093	0.104	0.621	0.000
1.3333	0.095	0.109	0.634	0.000
1.3889	0.096	0.114	0.647	0.000
1.4444	0.097	0.120	0.660	0.000
1.5000	0.098	0.125	0.673	0.000
1.5556	0.099	0.131	0.685	0.000
1.6111	0.100	0.136	0.697	0.000
1.6667	0.101	0.142	0.709	0.000
1.7222	0.102	0.147	0.721	0.000

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1.7778	0.104	0.153	0.732	0.000
1.8333	0.105	0.159	0.744	0.000
1.8889	0.106	0.165	0.755	0.000
1.9444	0.107	0.171	0.766	0.000
2.0000	0.108	0.177	0.777	0.000
2.0556	0.109	0.183	0.787	0.000
2.1111	0.111	0.189	0.798	0.000
2.1667	0.112	0.195	0.808	0.000
2.2222	0.113	0.201	0.819	0.000
2.2778	0.114	0.208	0.829	0.000
2.3333	0.115	0.214	0.839	0.000
2.3889	0.117	0.221	0.849	0.000
2.4444	0.118	0.227	0.859	0.000
2.5000	0.119	0.234	0.868	0.000
2.5556	0.120	0.241	0.878	0.000
2.6111	0.122	0.247	0.888	0.000
2.6667	0.123	0.254	0.897	0.000
2.7222	0.124	0.261	0.906	0.000
2.7778	0.125	0.268	0.931	0.000
2.8333	0.127	0.275	1.005	0.000
2.8889	0.128	0.282	1.106	0.000
2.9444	0.129	0.289	1.228	0.000
3.0000	0.130	0.296	1.368	0.000
3.0556	0.132	0.304	1.523	0.000
3.1111	0.133	0.311	1.691	0.000
3.1667	0.134	0.319	1.873	0.000
3.2222	0.136	0.326	2.067	0.000
3.2778	0.137	0.334	2.271	0.000
3.3333	0.138	0.341	2.486	0.000
3.3889	0.139	0.349	2.712	0.000
3.4444	0.141	0.357	2.946	0.000
3.5000	0.142	0.365	3.191	0.000
3.5556	0.143	0.373	3.443	0.000
3.6111	0.145	0.381	3.705	0.000
3.6667	0.146	0.389	3.974	0.000
3.7222	0.147	0.397	4.252	0.000
3.7778	0.149	0.405	4.537	0.000
3.8333	0.150	0.414	4.830	0.000
3.8889	0.151	0.422	5.131	0.000
3.9444	0.153	0.430	5.438	0.000
4.0000	0.154	0.439	5.752	0.000
4.0556	0.155	0.448	5.968	0.000
4.1111	0.157	0.456	6.355	0.000
4.1667	0.158	0.465	6.849	0.000
4.2222	0.160	0.474	7.419	0.000
4.2778	0.161	0.483	8.039	0.000
4.3333	0.162	0.492	8.680	0.000
4.3889	0.164	0.501	9.315	0.000
4.4444	0.165	0.510	9.915	0.000
4.5000	0.167	0.519	10.45	0.000
4.5556	0.168	0.529	10.92	0.000
4.6111	0.169	0.538	11.30	0.000
4.6667	0.171	0.548	11.59	0.000
4.7222	0.172	0.557	11.82	0.000
4.7778	0.174	0.567	12.10	0.000
4.8333	0.175	0.576	12.33	0.000
4.8889	0.177	0.586	12.55	0.000
4.9444	0.178	0.596	12.76	0.000

5.0000	0.180	0.606	12.96	0.000
5.0556	0.181	0.616	13.17	0.000

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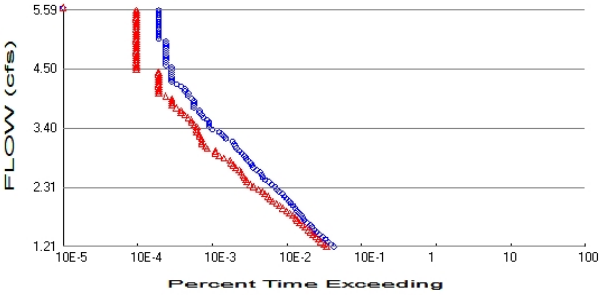
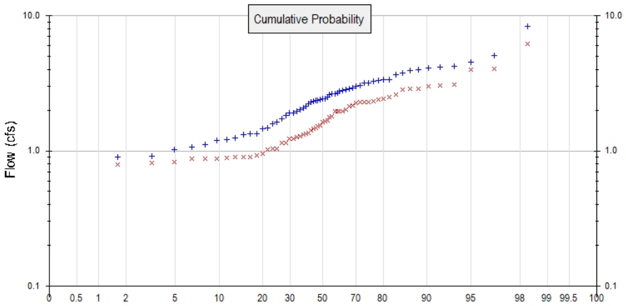
Analysis Results

POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area:	8.6377
Total Impervious Area:	0

Mitigated Landuse Totals for POC #1

Total Pervious Area:	2.5194
Total Impervious Area:	6.1183

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	2.429739
5 year	3.7419
10 year	4.450054
25 year	5.168118
50 year	5.593786
100 year	5.94324

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	1.576463
5 year	2.402139
10 year	3.035703
25 year	3.938572
50 year	4.687954
100 year	5.505321

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	1.827	1.474
1950	2.356	1.337
1951	3.193	1.311
1952	1.917	2.321
1953	2.612	1.015
1954	3.996	1.367
1955	2.007	0.898
1956	3.683	3.089
1957	3.256	1.540
1958	2.417	2.896

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1959	1.461	0.827
1960	1.343	1.624
1961	3.360	2.179
1962	2.349	1.221
1963	2.629	1.273
1964	2.439	1.142
1965	2.092	1.766
1966	2.926	1.464
1967	2.644	1.282
1968	3.164	2.299
1969	3.028	4.036
1970	8.378	6.168
1971	1.337	0.875
1972	2.136	1.036
1973	2.222	2.023
1974	3.364	3.026
1975	1.913	0.925
1976	2.888	1.806
1977	0.086	0.817
1978	4.206	2.622
1979	2.744	2.511
1980	1.589	0.877
1981	3.767	2.378
1982	2.492	2.878
1983	4.557	2.279
1984	1.470	0.887
1985	1.060	1.961
1986	1.312	1.675
1987	2.317	1.531
1988	1.107	0.901
1989	1.197	0.958
1990	1.019	0.896
1991	2.691	1.139
1992	2.783	0.876
1993	3.303	2.844
1994	2.384	1.964
1995	1.969	2.435
1996	4.141	3.980
1997	5.048	2.989
1998	4.079	1.966
1999	2.845	1.965
2000	1.628	0.780
2001	0.898	0.792
2002	3.924	1.412
2003	2.988	2.147
2004	0.913	1.653
2005	1.215	1.037
2006	2.303	1.225
2007	1.255	2.304
2008	1.734	2.276

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	8.3780	6.1683
2	5.0477	4.0358
3	4.5566	3.9802
4	4.2064	3.0890

5	4.1414	3.0262
6	4.0789	2.9888
7	3.9961	2.8963
8	3.9244	2.8784
9	3.7674	2.8445
10	3.6832	2.6216
11	3.3641	2.5112
12	3.3596	2.4353
13	3.3033	2.3782
14	3.2564	2.3213
15	3.1931	2.3044
16	3.1637	2.2994
17	3.0283	2.2787
18	2.9882	2.2763
19	2.9261	2.1788
20	2.8883	2.1469
21	2.8448	2.0234
22	2.7828	1.9655
23	2.7438	1.9647
24	2.6905	1.9640
25	2.6442	1.9613
26	2.6290	1.8063
27	2.6119	1.7658
28	2.4920	1.6747
29	2.4394	1.6534
30	2.4168	1.6244
31	2.3842	1.5405
32	2.3558	1.5311
33	2.3492	1.4744
34	2.3171	1.4644
35	2.3027	1.4115
36	2.2222	1.3666
37	2.1362	1.3368
38	2.0918	1.3110
39	2.0071	1.2816
40	1.9686	1.2734
41	1.9173	1.2246
42	1.9131	1.2209
43	1.8266	1.1423
44	1.7338	1.1394
45	1.6276	1.0370
46	1.5889	1.0358
47	1.4705	1.0154
48	1.4615	0.9577
49	1.3425	0.9250
50	1.3373	0.9009
51	1.3125	0.8980
52	1.2546	0.8959
53	1.2149	0.8870
54	1.1966	0.8770
55	1.1067	0.8762
56	1.0595	0.8754
57	1.0189	0.8273
58	0.9127	0.8175
59	0.8982	0.7916
60	0.0862	0.7803

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Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
1.2149	896	715	79	Pass
1.2591	823	659	80	Pass
1.3033	755	600	79	Pass
1.3476	687	553	80	Pass
1.3918	626	509	81	Pass
1.4360	576	466	80	Pass
1.4803	535	435	81	Pass
1.5245	493	404	81	Pass
1.5687	457	368	80	Pass
1.6130	431	340	78	Pass
1.6572	392	309	78	Pass
1.7014	364	288	79	Pass
1.7456	346	274	79	Pass
1.7899	324	251	77	Pass
1.8341	305	228	74	Pass
1.8783	287	208	72	Pass
1.9226	271	186	68	Pass
1.9668	253	168	66	Pass
2.0110	237	152	64	Pass
2.0553	226	135	59	Pass
2.0995	211	124	58	Pass
2.1437	193	117	60	Pass
2.1880	182	106	58	Pass
2.2322	165	98	59	Pass
2.2764	152	88	57	Pass
2.3207	145	75	51	Pass
2.3649	131	67	51	Pass
2.4091	120	61	50	Pass
2.4534	107	59	55	Pass
2.4976	100	56	56	Pass
2.5418	96	54	56	Pass
2.5860	91	51	56	Pass
2.6303	83	48	57	Pass
2.6745	75	43	57	Pass
2.7187	71	40	56	Pass
2.7630	69	38	55	Pass
2.8072	62	36	58	Pass
2.8514	59	30	50	Pass
2.8957	56	26	46	Pass
2.9399	52	23	44	Pass
2.9841	49	23	46	Pass
3.0284	44	18	40	Pass
3.0726	43	17	39	Pass
3.1168	41	15	36	Pass
3.1611	39	15	38	Pass
3.2053	32	15	46	Pass
3.2495	30	14	46	Pass
3.2937	28	14	50	Pass
3.3380	26	13	50	Pass
3.3822	21	13	61	Pass
3.4264	19	13	68	Pass
3.4707	19	12	63	Pass
3.5149	19	11	57	Pass

3.5591	18	11	61	Pass
3.6034	16	10	62	Pass
3.6476	15	9	60	Pass
3.6918	14	8	57	Pass
3.7361	14	8	57	Pass
3.7803	12	7	58	Pass
3.8245	12	6	50	Pass
3.8688	12	6	50	Pass
3.9130	12	6	50	Pass
3.9572	11	6	54	Pass
4.0015	10	5	50	Pass
4.0457	10	4	40	Pass
4.0899	9	4	44	Pass
4.1341	9	4	44	Pass
4.1784	8	4	50	Pass
4.2226	7	4	57	Pass
4.2668	6	4	66	Pass
4.3111	6	4	66	Pass
4.3553	6	4	66	Pass
4.3995	6	4	66	Pass
4.4438	6	4	66	Pass
4.4880	6	2	33	Pass
4.5322	6	2	33	Pass
4.5765	5	2	40	Pass
4.6207	5	2	40	Pass
4.6649	5	2	40	Pass
4.7092	5	2	40	Pass
4.7534	5	2	40	Pass
4.7976	5	2	40	Pass
4.8419	5	2	40	Pass
4.8861	5	2	40	Pass
4.9303	5	2	40	Pass
4.9745	5	2	40	Pass
5.0188	5	2	40	Pass
5.0630	4	2	50	Pass
5.1072	4	2	50	Pass
5.1515	4	2	50	Pass
5.1957	4	2	50	Pass
5.2399	4	2	50	Pass
5.2842	4	2	50	Pass
5.3284	4	2	50	Pass
5.3726	4	2	50	Pass
5.4169	4	2	50	Pass
5.4611	4	2	50	Pass
5.5053	4	2	50	Pass
5.5496	4	2	50	Pass
5.5938	4	2	50	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Trapezoidal Pond 1 POC	☐	1260.38			☐	0.00			
Total Volume Infiltrated		1260.38	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

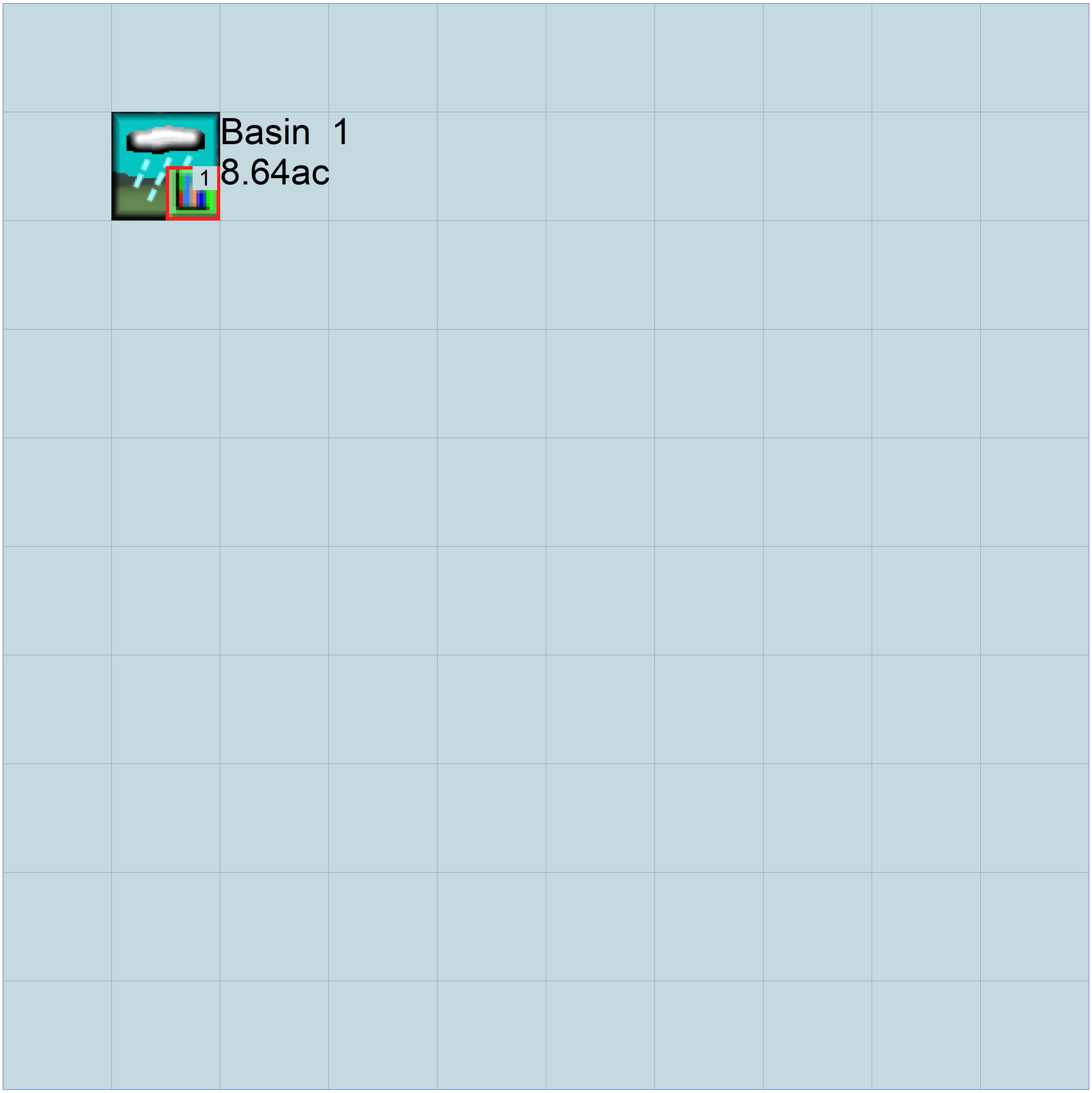
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Basin 1.wdm
MESSU      25   PreBasin 1.MES
           27   PreBasin 1.L61
           28   PreBasin 1.L62
           30   POCBasin 11.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      29
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                  MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   29     SG4, Forest, Mod        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   29         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   29         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

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```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   29         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   29               0         6      0.04       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   29               0         0         3         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                 ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   29             0.2       0.4      0.35         2       0.4       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   29               0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                   in  out          ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

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```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  29                      8.6377     COPY   501     12
PERLND  29                      8.6377     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                          ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                     ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Basin 1.wdm
MESSU      25   MitBasin 1.MES
           27   MitBasin 1.L61
           28   MitBasin 1.L62
           30   POCBasin 11.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      25
      IMPLND       1
      IMPLND       4
      IMPLND       5
      IMPLND       8
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Trapezoidal Pond  1         MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   25      SG3, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   25         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   25        0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   25        0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   25             0         9      0.05       400      0.05         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   25             0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   25           0.1       0.8      0.25         4       0.4      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   25             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    5      DRIVEWAYS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1        0    0    1    0    0    0
    4        0    0    1    0    0    0
    5        0    0    1    0    0    0
    8        0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1        0    0    4    0    0    4    1    9
    4        0    0    4    0    0    0    1    9
    5        0    0    4    0    0    0    1    9
    8        0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
```

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```
    # -  # CSNO RTOP  VRS  VNN RTLI         ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    5              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    5              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  25                      2.5194     RCHRES   1      2
PERLND  25                      2.5194     RCHRES   1      3
IMPLND   1                       1.342     RCHRES   1      5
IMPLND   4                      4.0645     RCHRES   1      5
IMPLND   5                      0.3809     RCHRES   1      5
IMPLND   8                      0.3309     RCHRES   1      5

******Routing******
PERLND  25                      2.5194     COPY     1     12
IMPLND   1                       1.342     COPY     1     15
IMPLND   4                      4.0645     COPY     1     15
IMPLND   5                      0.3809     COPY     1     15
IMPLND   8                      0.3309     COPY     1     15
PERLND  25                      2.5194     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
```

Exhibit 21 SUB25-1004

```
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
    1     Trapezoidal Pond-005    1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1         0          4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.069559  0.000000  0.000000
  0.055556  0.070559  0.003892  0.129523
  0.111111  0.071564  0.007840  0.183173
  0.166667  0.072573  0.011844  0.224341
  0.222222  0.073588  0.015904  0.259046
  0.277778  0.074608  0.020020  0.289623
  0.333333  0.075634  0.024194  0.317266
  0.388889  0.076664  0.028424  0.342686
  0.444444  0.077699  0.032712  0.366347
  0.500000  0.078740  0.037058  0.388570
  0.555556  0.079785  0.041461  0.409588
  0.611111  0.080836  0.045923  0.429580
  0.666667  0.081892  0.050443  0.448681
  0.722222  0.082953  0.055022  0.467002
  0.777778  0.084018  0.059660  0.484631
  0.833333  0.085090  0.064358  0.501641
  0.888889  0.086166  0.069115  0.518093
  0.944444  0.087247  0.073932  0.534038
  1.000000  0.088333  0.078809  0.549520
  1.055556  0.089425  0.083747  0.564578
  1.111111  0.090521  0.088745  0.579245
  1.166667  0.091623  0.093805  0.593550
```

```
  1.222222  0.092730  0.098926  0.607518
  1.277778  0.093842  0.104108  0.621171
  1.333333  0.094959  0.109353  0.634531
  1.388889  0.096081  0.114659  0.647616
  1.444444  0.097208  0.120028  0.660441
  1.500000  0.098340  0.125460  0.673022
  1.555556  0.099478  0.130955  0.685372
  1.611111  0.100620  0.136514  0.697504
  1.666667  0.101768  0.142135  0.709428
  1.722222  0.102920  0.147821  0.721155
  1.777778  0.104078  0.153571  0.732694
  1.833333  0.105241  0.159386  0.744054
  1.888889  0.106409  0.165265  0.755243
  1.944444  0.107582  0.171209  0.766269
  2.000000  0.108760  0.177218  0.777139
  2.055556  0.109944  0.183294  0.787859
  2.111111  0.111132  0.189435  0.798435
  2.166667  0.112326  0.195642  0.808872
  2.222222  0.113524  0.201915  0.819177
  2.277778  0.114728  0.208256  0.829353
  2.333333  0.115937  0.214663  0.839406
  2.388889  0.117151  0.221138  0.849340
  2.444444  0.118370  0.227680  0.859160
  2.500000  0.119594  0.234290  0.868868
  2.555556  0.120823  0.240968  0.878469
  2.611111  0.122057  0.247715  0.887966
  2.666667  0.123297  0.254530  0.897363
  2.722222  0.124541  0.261415  0.906662
  2.777778  0.125791  0.268368  0.931284
  2.833333  0.127045  0.275392  1.005088
  2.888889  0.128305  0.282485  1.106369
  2.944444  0.129570  0.289648  1.228464
  3.000000  0.130840  0.296881  1.368047
  3.055556  0.132115  0.304186  1.523014
  3.111111  0.133396  0.311561  1.691875
  3.166667  0.134681  0.319008  1.873506
  3.222222  0.135971  0.326526  2.067016
  3.277778  0.137267  0.334116  2.271681
  3.333333  0.138567  0.341778  2.486891
  3.388889  0.139873  0.349512  2.712130
  3.444444  0.141184  0.357319  2.946950
  3.500000  0.142500  0.365199  3.190957
  3.555556  0.143821  0.373153  3.443803
  3.611111  0.145147  0.381180  3.705177
  3.666667  0.146478  0.389280  3.974798
  3.722222  0.147815  0.397455  4.252411
  3.777778  0.149156  0.405704  4.537785
  3.833333  0.150503  0.414028  4.830705
  3.888889  0.151854  0.422427  5.130977
  3.944444  0.153211  0.430901  5.438417
  4.000000  0.154573  0.439451  5.752857
  4.055556  0.155940  0.448076  5.968734
  4.111111  0.157312  0.456778  6.355822
  4.166667  0.158689  0.465555  6.849790
  4.222222  0.160071  0.474410  7.419918
  4.277778  0.161459  0.483341  8.039214
  4.333333  0.162851  0.492350  8.680254
  4.388889  0.164249  0.501436  9.314964
  4.444444  0.165651  0.510600  9.915940
  4.500000  0.167059  0.519842  10.45862
  4.555556  0.168472  0.529162  10.92405
  4.611111  0.169890  0.538561  11.30217
  4.666667  0.171313  0.548039  11.59541
  4.722222  0.172741  0.557596  11.82272
  4.777778  0.174175  0.567233  12.10482
  4.833333  0.175613  0.576949  12.33114
  4.888889  0.177056  0.586745  12.55023
  4.944444  0.178505  0.596622  12.76274
  5.000000  0.179959  0.606579  12.96925
  END FTABLE  1
```

```
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.3            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.3            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1       WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1       WDM   1001 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4       WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4       WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Exhibit 21 SUB25-1004

Mitigated HSPF Message File

Disclaimer

Legal Notice

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Olympia, WA. 98501
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Local (360)943-0304

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Exhibit 21 SUB25-1004

APPENDIX C

Geotechnical Report

TRUE NORTH
GEOTECHNICAL

Pacific Lifestyle Homes
Geotechnical Engineering Evaluation

Reserve at Green Mountain (Formerly Bahu Property)
2625 NE Goodwin Road
Camas, Washington

True North Project No. 24-0368-2

April 2025 (revised May 2025)

April 18, 2025 (revised May 22, 2025)

Pacific Lifestyle Homes (PLH)
11815 NE 99th Street, Suite 1200
Vancouver, WA 98682
Attn: Nick Edwards
Email: nicke@buildplh.com

Subject: Geotechnical Engineering Evaluation
Reserve at Green Mountain Subdivision (Formerly Bahu Property)
2625 NE Goodwin Road
Camas, Clark County, Washington
Clark County Parcel No. 173192000
True North Project # 24-0368-2

True North Geotechnical Services (True North) is pleased to submit our finalized Geotechnical Engineering Evaluation for the project noted above. This report was prepared in accordance with "True North Geotechnical - General Services Agreement (GSA) P24-0368-2" dated March 18, 2025, which was authorized by Samantha Zimmer with PLH on March 20, 2025. This report is intended to build off our conclusions summarized in our previously issued report, "Preliminary Geotechnical Engineering Evaluation – Goodwin Road (Bahu)", dated December 3, 2024. This report summarizes the entirety of our work accomplished and provides our geotechnical recommendations for development of the property with the proposed Reserve at Green Mountain development.

PROJECT UNDERSTANDING

Our current understanding of the project is based on the information provided to True North by Pacific Lifestyle Homes (PLH) and their project civil engineer, PLS Engineering. We have been provided the following document related to the proposed project:

- **A one-page drawing, titled "Reserve at Green Mountain PRD", undated, prepared by PLS Engineering**. This pre-application drawing shows the proposed layout of the development, including 49 single-family lots, a network of 2-lane local streets, and the proposed stormwater facility. The proposed development is overlain on the site's existing conditions and includes a wetland buffer for the mapped potential wetland in the southern quarter of the site.

Briefly, we understand that the subdivision will be developed with 49 single-family residential lots with concrete driveways. The remainder of the property will be developed with asphalt paved roads, associated utilities, landscape/hardscape, and stormwater infiltration facilities. The south of the site includes proposed recreational open space, including passive areas (wetland and buffer), and active open space for public recreation.

We understand this project is in the preliminary planning stages. As such, we have not been provided any structural drawings or foundation loads other than an indication that the single-family residences will be 1- or 2-story buildings. Preliminarily, we have assumed that maximum building loads will on the order of be 4 kips per linear foot for continuous wall footings, 25 kips per isolated column footing, and 150 psf for floor slabs on grade. As the site is generally flat, or gently sloped, we anticipate cuts and fills no greater than 2 to 4 feet, with the exception of utility trenches, and assuming the proposed new residences are not planned to have basements. Finally, we have assumed that the proposed development will be constructed in accordance with the provisions of the 2021 International Building Code (IBC) as well as any jurisdictional code requirements.

SCOPE OF SERVICES

The purpose of our services was to explore the site surface and subsurface conditions in order to provide geotechnical recommendations for the proposed development. The following describes our specific scope of services:

- **Geologic Map Review**: We reviewed relevant available geologic maps of the site for information regarding geologic conditions and hazards at or near the site.
- **Subsurface Explorations**: We excavated a total of 9 test pits (TP-1 through TP-9) to depths ranging between 4.5 and 11 feet below existing ground surface (bgs) across the proposed development area, at the locations shown on Figure 2. Soil samples were collected from the major strata encountered in each test pit.
- **Infiltration Testing:** Infiltration testing was attempted, but due to shallow groundwater and unsuitable soils, could not be performed.
- **Laboratory Testing:** All samples were returned to our office and select samples were subjected to additional laboratory testing, that included: in-situ moisture content and fines content testing.
- **Engineering Analyses:** All data collected during the subsurface exploration, literature research, and laboratory testing was evaluated and used to develop geotechnical design and construction recommendations.
- **Geotechnical Engineering Evaluation:** This document summarizes our geotechnical engineering evaluation services, and includes:
  - A site vicinity map and site plan showing the approximate locations of our explorations.
  - A discussion of subsurface conditions encountered including pertinent soil and rock properties as well as the encountered groundwater conditions.
  - Geotechnical related recommendations for foundation design including allowable bearing capacity and estimated settlements.
  - Seismic design parameters in accordance with ASCE 7-16.
  - The results of our infiltration testing.
  - Structural fill recommendations, including an evaluation of whether the in-situ soils can be used as structural fill.
  - Floor slab support recommendations.

- General retaining wall design parameter recommendations, including earth pressures, backfill, and drainage.
- Flexible and rigid pavement design recommendations.
- General comments regarding site grading and drainage.
- Discussions on other geotechnical issues that may impact the project.

SITE CONDITIONS

Surface Description

The proposed development is an 11.67-acre lot, located at 2625 NE Goodwin Road, Camas, Clark County, Washington; Clark County Parcel # 173192000. The site is bound to the north by NE Goodwin Road and to the east and west by similarly rural single-family residences. The parcel to the south is maintained as an open park space by Clark County Parks.

The current development at the site consists of one single-family residence and attached garage, two outbuildings, a concrete well house, a paved driveway, and all utilities associated with the residence (including a septic tank to the east of the existing residence and a power vault to the north of the residence). It is our understanding that the single-family residence will remain while the existing outbuildings, well house, and driveway on site will be demolished as part of development activities.

There is significant variation in vegetation over the ground surface of the lot. The northern third of the site, abutting NE Goodwin Road, generally consists of an open pasture. Vegetation in this area consists of thick, hummocky, knee-high grasses, tall weeds, and blackberry bushes along the existing fence lines. The existing outbuildings and well house are located in the central third of the site, which is largely characterized by mature evergreen trees, significant stands of blackberry bushes (especially around the southern outbuilding, well house, and along the east and west property lines), and maintained lawn along the existing driveway. The existing residence is located in the southern third of the site, which is largely made up of a field of maintained, low grass transitioning to wetland vegetation in the southwest and southern extents of the site.

In terms of topography, the northeastern corner of the property is located at 234 feet AMSL (above median sea level), and the site descends at a gentle 0 to 10 percent gradient to the southwestern corner of the property, which is located at 196 feet AMSL. Within the proposed development area, the ground surface is locally flatter and approximately terraced, with an approximate 0 to 5 percent gradient descending to the south. The existing residence sits at the southern extent of this terrace, and south of the existing residence, the local slopes are slightly steeper as they descend into the wetland and proposed open space, with a 5 to 10 percent gradient.

Geologic Setting

The map area lies on the eastern margin of the Portland Basin, which is part of the Puget-Willamette Lowland that separates the Cascade Range from the Oregon Coast Range. Since late Eocene time, the Cascade Range has been the locus of an episodically active volcanic arc associated with underthrusting of oceanic lithosphere beneath the North American continent along the Cascadia Subduction Zone.

The underlying geologic unit at the subject property is mapped by the Washington Geologic Information Portal as "QTc – Quaternary-Tertiary continental sedimentary rocks and deposits – conglomerate with sandy and silty facies. Quaternary-Miocene pebble, cobble, and boulder gravel. Pleistocene-Pliocene gravel, sand, silt, and clay; deposits of the ancestral Columbia River."

According to the USDA Soil Survey, there are a number of surficial soils mapped at the site.

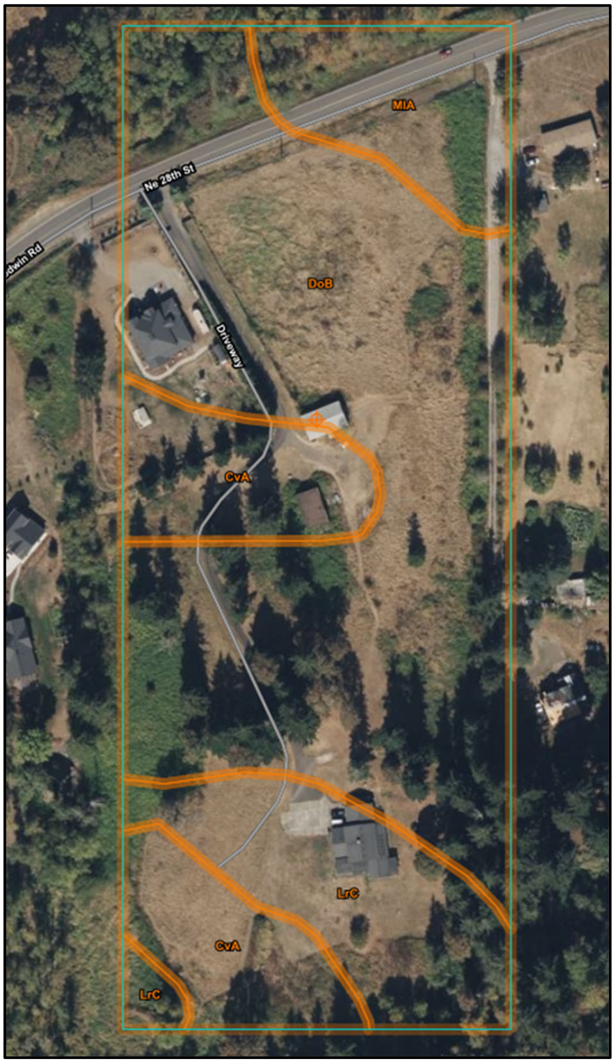


Exhibit 1: USDA mapped surficial soils at the site

In the northeastern corner of the site, surface soils are mapped as the "MIA: McBee silt loam, coarse variant, 0 to 3 percent slopes". The McBee series consists of somewhat poorly drained soils that permeate at a moderately high to high rate. These soils formed in alluvium and are found in depressions and drainageways. In the area of the existing outbuildings in the center of the site and in the southwestern corner of property, surface soils are mapped as “CvA: Cove silty clay loam, 0 to 3 percent slopes”. The Cove series is poorly drained, with moderately low to moderately high permeability, and are generally encountered within flood plains. Both the McBee and Cove series are characterized as hydric soils, which have shallow depths to the water table and experience regular or extended flooding or ponding.

Additional soil types mapped at the site include “DoB: Dollar loam, 0 to 5 percent slopes”, and “LrC: Lauren gravelly loam, cemented substratum, 3 to 15 percent slopes”. Both the Dollar and Lauren series are moderately well drained, with very low to high permeability.

Subsurface Conditions

On November 4, 2024, we visited the site to excavate five exploratory test pits (TP-1 through TP-5), as part of our preliminary evaluation of the site. On March 21, 2025 we returned to excavate four additional test pits (TP-6 through TP-9). In all, we excavated a total of 9 test pits to depths ranging between 4.5 and 11 feet below existing ground surface (bgs) across the proposed development area. Soil samples were collected from the major strata encountered in each test pit and were returned to our office for examination and index testing. See Figure 2 - Site & Exploration Plan for the locations of our explorations.

As indicated above, the subsurface conditions at the site are highly variable and the conditions encountered in our explorations appear consistent with the soil types indicated in regional soil maps. Descriptions of field and lab procedures and the exploration logs are included in Appendix A. The following is a highly generalized description of the subsurface units encountered:

FILL:

At the ground surface of TP-2, we encountered 2 feet of soft, silt with clay, undocumented fill, overlying 6 inches of crushed gravel. As this material will be removed as part of development activities, we did not perform any laboratory testing on this layer.

SILT:

At the ground surface in all the explorations except TP-2, we encountered dark brown to red-brown soft to medium stiff SILT with Clay and Clayey SILT. At TP-2, we first encountered this layer beneath the undocumented fill, at 2.5 feet bgs. In TP-1 and TP-2, in the northeast portion of the site, these soft to medium stiff, fine-grained soils extended to depths of 6 to 9 feet. Over the remainder of our explorations these surficial fine-grained soils extended to 1.5 to 5 feet bgs.

Laboratory tests conducted on soil samples collected from this layer returned moisture contents ranging from 21 to 32 percent, and fines contents ranging from 54 to 77 percent.

SAND:

Underlying the silt material found at TP-1, TP-4, TP-6 and TP-8, we encountered medium dense to very dense SAND with varying amounts of fines (clay and gravel). This layer extended to depths ranging between 2 and 9 feet bgs.

Laboratory testing conducted on this layer returned moisture contents ranging between 19 and 41 percent and fines contents ranging between 39 and 49 percent..

GRAVEL (WEATHERED BEDROCK):

Underlying the silt or sand material found in all test pits except TP-3 and TP-4, we encountered dense to very dense GRAVEL with varying amounts of clay, extending to the termination depth of those explorations where it was encountered explorations. This material was interpreted to be weathered bedrock at depths.

Laboratory tests conducted on soil samples collected from these layers returned moisture contents ranging from 19 to 55 percent, and a fines content of 25 percent.

As previously mentioned, the subsurface conditions at the site exhibited significant variation, consistent with the multiple mapped USDA soil types within the property. The above generalized descriptions are a rough overview of the encountered conditions. More detailed information of subsurface conditions can be found in the attached Test Pit Logs in Appendix A.

Groundwater

Groundwater was encountered at TP-1, TP-2, TP-3, TP-6, TP-8, and TP-9, at depths of 5, 8.5, 6, 3.5, 1.5, and 3 feet bgs, respectively. TP-1 and TP-6 were excavated near mapped hydric soils in the southeast corner of the site, while TP-2, TP-4, TP-8 and TP-9 were excavated in non-hydric soils. Data published on Clark County MapsOnline indicates that groundwater at the site is between 0 to 10 feet bgs, which agrees with groundwater conditions observed in our explorations.

Depending on the time of year of construction, it may be possible that groundwater could be an issue during shallow foundation construction. Additionally, utility trenches may encounter perched water and infiltration facilities will need to be located at a shallow enough depth that adequate vertical spacing is provided between the bottom of the facility and seasonal high groundwater. Groundwater elevations can fluctuate depending on the time of year of construction and changes in land use.

Infiltration Testing/Feasibility

Based on the presence of shallow groundwater at most of our explorations and the lack of suitable soils above the groundwater table for infiltration, infiltration testing could not be reliably completed at the property. It is our opinion that subsurface infiltration is not a feasible method of stormwater management at this site.

Geologic Hazards Review

The following provides a geologic hazards review for the subject site in accordance with CCC 40.430. The geologic hazard review is based on our site reconnaissance and explorations, as well as a review of publicly available published literature and maps.

Mapped Hazards: As a part of our due diligence, we reviewed the Clark County Property Information Center - MapsOnline website (https://gis.clark.wa.gov/gis/property) for information on geologic hazards present at this property. No geologic hazards are mapped on this property. The site is mapped as having an NEHRP site class C and very low liquefaction susceptibility. We address the applicable sections of CCC 40.430 below:

Liquefaction: As stated above, the area to be developed is mapped as having a very low liquefaction susceptibility. This corresponds to the conditions observed in our explorations where dense soils with a significant coarse material percentage (eg, sand, gravel, cobbles, or boulders) were encountered at relatively shallow depths ranging between 1.5 and 9 feet bgs. Dense, large-grained soils below the water table (encountered at 5 feet bgs at the shallowest) have a very low potential for liquefaction.

Ground Motion Amplification: In accordance with ASCE 7-16, we recommend a Site Class C (dense soil and soft rock soil profile with an average N-value greater than 50) for this site when considering the average of the upper 100 feet of bearing material beneath the foundations. This recommendation is based on the results of our subsurface investigation as well as our understanding of the local geology. Inputting our recommended Site Class as well as the site latitude and longitude into the ACSE 7 website (ASCE 7 Hazard Tool), we obtained the seismic design parameters shown in Table 1 below. Note that the values for F_a and F_v in Table 2 were obtained from ASCE's Supplement 3 dated November 5, 2021 and issued for ASCE 7-16 to correct some seismic design issues in the original publication.

Table 1. 2021 IBC (ASCE 7-16, Supplement 3) Seismic Design Parameters

Location	Short Period	1-Second
Maximum Credible Earthquake Spectral Acceleration	S_s = 0.797 g	S_1 = 0.351 g
Site Class	C	
Site Coefficient	F_a = 1.2	F_v= 1.5
Adjusted Spectral Acceleration	S_{MS} = 0.957 g	S_{M1} = 0.527 g*
Design Spectral Response Acceleration Parameters	S_{DS} = 0.638 g	S_{D1} = 0.351 g
MCE_G Peak Ground Acceleration	MCE_G PGA = 0.357 g	
Site Amplification Factor at PGA	F_{PGA} = 1.2	
Site Modified Peak Ground Acceleration	PGA_M = 0.429 g	

g – acceleration due to gravity, * See note below.

The return interval for the ground motions reported in the table above is 2 percent probability of exceedance in 50 years.

CONCLUSIONS AND RECOMMENDATIONS

Geotechnical Design and Construction Considerations

Based on the results of our Geotechnical Engineering Evaluation, development of the site with the proposed development is feasible provided the recommendations in this report are included in the project design and implemented during construction.

The primary geotechnical concerns associated with the project are:

1. **Presence of soft surficial soils.** As noted above, we encountered variable depths of fill and/or soft surficial soils across the site, ranging in thickness between 0.5 and 2.5 feet below existing ground surface (bgs). The fill encountered in TP-2 extended to about 2.5 feet bgs and consisted of 2 feet of soft silt with clay underlain by 6 inches of ¾” minus gravel. During mass grading we expect much of the surficial soils will be removed from the site or stockpiled for use in landscape areas. Once the subgrade has been approved by True North, mass grading may begin using suitable onsite material or imported structural/engineered fill. We expect that foundations will generally bear on properly placed and compacted structural/engineered fill.

2. **Presence of shallow groundwater and seepage.** As stated above, we encountered shallow groundwater in several of our explorations across the site, in both mapped hydric soils areas, and outside of these areas. We do not anticipate that generally groundwater will become an issue for mass grading and shallow foundation construction. However, given that groundwater was encountered at 1.5 feet bgs at TP-8, it is more likely that groundwater may present an issue during mass grading and shallow foundation construction in the north of the site, and particularly during the wet winter months.

   Additionally, utility trenches and other embedded structure excavations will likely encounter groundwater during development of the site. The contractor will need to be prepared for this condition.

   Finally, due to the presence of shallow groundwater across the site, it is our opinion that the subsurface conditions are not conducive to the use of infiltration for stormwater management for the proposed project.

In summary, provided the recommendations in this report are adhered to, we do not foresee any major issues that would preclude the proposed development. The above-mentioned factors are listed to draw the attention of the reader to the issues to address during design and construction.

Moisture Sensitive Soils/Weather Related Concerns

The fine-grained soils at this site are considered moisture sensitive. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

Given the depth of the soft surficial soils encountered across this site, the contractor may need to consider the construction of temporary haul roads depending on the time of year construction takes place. True North can provide more detailed wet weather recommendations if needed. Stormwater should not be allowed to collect on prepared subgrades.

Site Preparation

Site preparation will include clearing, grubbing, etc. to remove the upper organic and fill soils to expose the underlying, native, medium dense silty sand and/or very dense, silty gravel and cobbles. Once the stripping has been approved we recommend proofrolling the site with a fully loaded, tandem axle dump truck to identify any excessively soft spots under the observation of the Geotechnical Engineer during various phases of construction to ensure proper fill placement. Areas not able to be adequately proofrolled (or where not practical) will be evaluated by the Geotechnical Engineer using a ½-inch diameter steel probe rod. Any soft spots identified should be over excavated to expose firm and unyielding soils and replaced with compacted structural fill.

Any utilities present beneath the proposed construction will need to be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed to inhibit the potential for subsurface erosion. Utility trench excavations should be backfilled with properly compacted structural fill in accordance with the structural fill recommendations in this report.

It should be noted that, due to the soft surficial soils observed over much of the site, construction traffic on these upper soils may have a difficult time moving around on site. We recommend consideration be given to constructing haul roads depending on site conditions at the time of construction.

Subgrade Verification

Following site preparation, including removal of all topsoil/till zone and compaction of the exposed subgrade and prior to placing aggregate base for the foundations, building pad, or pavement section, the exposed subgrade should be evaluated. The subgrades should be evaluated by qualified True North personnel using a steel foundation probe. Unsuitable areas identified during the field evaluation should be re-compacted to or be excavated to firm ground and replaced with structural fill.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document and subsequent updates were issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

Depending on the time of year, and the depth of the excavation, groundwater may be encountered at shallow depths. If groundwater is encountered during excavation, the soils encountered in our subsurface explorations should be classified as Type C soil according to the most recent OSHA regulations. If groundwater is not encountered or dewatering is accomplished in advance of excavation, the soils may be classified as Type B soil. In our opinion, excavations should be safely sloped or shored.

If groundwater is encountered during excavation, positive groundwater control will be required, including the possibility of wells extending below the depth of excavation. Groundwater levels will be lowest in the dry season, and construction during that time will minimize groundwater control problems. The groundwater conditions at the time of construction and the contractor’s ability to control these conditions will control the degree of inclination of temporary slopes. In our opinion, temporary excavation slopes can be constructed as steep as 1.5H:1V, if groundwater levels are maintained at least 2 feet below the bottom of the excavation. Slopes should be flattened if significant seepage or running soils are encountered.

If slopes of this inclination, or flatter, cannot be constructed, or if excavations greater than four feet in depth are required, temporary shoring may be necessary. This shoring would help protect against slope or excavation collapse and would provide protection to workmen in the excavation.

We are providing this information solely as a service to our client. True North does not assume responsibility for construction site safety or the contractor's compliance with local, state, and federal safety or other regulations.

Construction Dewatering

The results of our subsurface investigations indicate that the groundwater seepage at the site is located some 3 to 5 feet below the ground surface, and will fluctuate in response to seasonal precipitation. Excavations that extend below the groundwater level may result in caving, heaving, or running soils, especially if excavations extend into the sandy clay soils encountered in our explorations. The contractor should consider the use of a network of ditches and sumps, into which water can flow to be pumped out of the excavation.

The depth and dewatering time will need to be determined at the time of construction and adjusted depending on site conditions. Unprotected working should not be allowed near temporary un-shored excavations until groundwater levels have been stabilized and shoring, such as trench shields or bracing, has been installed.

Structural Fill

Structural fill should be granular, free of organics or other deleterious materials, have a maximum particle size less than 3 inches, be relatively well graded, and have a liquid limit less than 45 and plasticity index less than 25. In our professional opinion, we anticipate the surficial fine-grained soils stripped from this site may be used only in landscape areas. These soils are moisture sensitive and could be difficult (depending on time of year of construction) to properly moisture condition and place. As such, the contractor will need to account for the need to import material to raise site grades. We recommend crushed rock structural fill be placed beneath footings, slabs, or other structural elements to allow for uniform load distribution, to provide protection from the elements, and to create a clean working surface.

We recommend all structural fill be moisture conditioned to within 3 percentage points below and 2 percentage points above optimum moisture as determined by ASTM D1557 (modified proctor). If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying.

Fill should be placed in relatively uniform horizontal lifts on the prepared subgrade which has been stripped of deleterious materials (i.e. topsoil and fill) and approved by the Geotechnical Engineer or his representative. Each loose lift should be about 1-foot thick. The type of compaction equipment used will ultimately determine the maximum lift thickness. Structural fill should be compacted to at least 95 percent of modified proctor maximum dry density as determined by ASTM D1557. Each lift of compacted engineered fill should be tested by a representative of the Geotechnical Engineer prior to placement of subsequent lifts.

Utility Trench Backfill

Trench backfill for the utility pipe base and pipe zone should consist of well-graded granular material with a maximum particle size of ¾ inch and less than 8 percent by weight passing the U.S. Standard No. 200 Sieve. The material should be free of roots, organic matter, and other unsuitable materials.

Trench backfill should be compacted to at least 90 percent of the maximum dry density at depths greater than 4 feet below finished grade and to 95 percent of the maximum dry density within 4 feet of finished grade. Compaction is based on ASTM D1557/AASHTO T-180, the modified proctor test, or as recommended by the pipe manufacturer.

Foundation Recommendations

Once the site has been properly prepared as discussed above, the planned construction can be supported on a conventional shallow foundation system. All foundations should bear on native, undisturbed, medium stiff clayey silt, or, heavily recompacted, native, sandy clay, or, atop compacted granular crushed rock structural fill placed atop the approved subgrade soils. Spread footings for building columns and continuous footings for bearing walls supported on the above-mentioned materials can be designed for an allowable soil bearing pressure of 2,000 psf based on dead load plus design live load and can be increased by one-third when including short-term wind or seismic loads. The above allowable soil bearing pressures can be increased by one-third when including short-term wind or seismic loads. Construction shall be accomplished in accordance with the 2021 International Building Code (IBC).

Lateral frictional resistance between the base of footings and the subgrade can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.33 for concrete foundations bearing directly on the subgrade soils described above or on compacted structural fill placed atop that strata In addition, lateral loads may be resisted by passive earth pressures based on an equivalent fluid pressure of 250 pounds per cubic foot (pcf) for footings poured “neat” against the above-mentioned soil/rock strata. These are ultimate values—we recommend a factor of safety of 1.5 be applied to the equivalent fluid pressure, which is appropriate due to the amount of movement required to develop full passive resistance.

Exterior footings and foundations in unheated areas should be located at a depth of at least 18 inches below the final exterior grade to provide adequate frost protection. If the construction takes place during the winter months and the foundation soils will likely be subjected to freezing temperatures after foundation construction, then the foundation soils should be adequately protected from freezing. Otherwise, interior foundations can be located at nominal depths compatible with architectural and structural considerations.

The foundation excavations should be observed by a representative of the Geotechnical Engineer prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Unsuitable soil zones encountered at the bottom of the foundation excavations should be removed and replaced with properly compacted structural fill as directed by the Geotechnical Engineer.

The fine-grained soils at this site are moisture sensitive. As such, they should be kept to as close to their in-situ moisture content. This should be accomplished during construction by covering the soil subgrade the same day it is exposed with crushed rock structural fill. Surface run-off water should be drained away from the excavations and not be allowed to pond.

Based on the known subsurface conditions we anticipate that properly designed and constructed foundations supported on the above-mentioned materials could experience maximum total settlement on the order of 1-inch and differential settlement on the order of 1/2-inch over 30 horizontal feet.

Granular Pads: Granular pads should be used if unsuitable foundation conditions are encountered at the proposed foundation subgrade elevations. Granular pads should extend 6 inches horizontally beyond the margins of the footings for each foot of the pad thickness or to the depth of firm, undisturbed native soil. The granular pads should be a minimum of 6 inches thick, however if embedded structures are encountered in the foundation areas, the embedded structure should be removed down to a minimum 24-inches below the base of footing, and granular pads should be thickened accordingly.

The granular pads should consist of ¾-inch minus crushed rock that is fairly well graded between coarse and fine, contains no organic matter or other deleterious materials, and has less than 5 percent passing the U.S. Standard No. 200 Sieve. The imported crushed rock should be compacted to not less than 92 percent of the maximum dry density, as determined by ASTM D 698.

Retaining Walls

We were not provided any construction drawings that would indicate if site retaining walls are necessary to complete the grading of the site. True North is available to provide a separate retaining wall design for any planned walls. We provide the following recommendations for use by the Structural Engineer in the event additional stem walls or other concrete structural walls are required for the homes.

The foundations for the proposed walls should be designed in accordance with foundation recommendations above. Lateral earth pressures on walls, which are not restrained at the top, may be calculated on the basis of an “active” equivalent fluid pressure of 35 pcf for level backfill, and 60 pcf for sloping backfill with a maximum 2H:1V slope. Lateral earth pressures on walls that are restrained from yielding at the top (i.e. stem walls) may be calculated on the basis of an “at-rest” equivalent fluid pressure of 55 pcf for level backfill, and 90 pcf for sloping backfill with a maximum 2H:1V slope. The stated equivalent fluid pressures do not include surcharges, such as foundation, vehicle, equipment, etc., behind walls, hydrostatic pressure buildup, or earthquake loading.

For seismic loading on retaining walls with level backfill, new research indicates that the seismic load is to be applied at 1/3 H of the wall instead of 2/3 H, where H is the height of the wall. We recommend that a Mononobe-Okabe earthquake thrust per linear foot of 4.8 psf* H^2 be applied at 1/3 H, where H is the height of the wall measured in feet. For a maximum 2H:1V slope we recommend 8.5 psf*H^2. This assumes a combination of soil and granular backfill retained by the walls within the active wedge.

All backfill for retaining walls should be select granular material, such as sand or crushed rock with a maximum particle size between ¾ and 1 ½ inches, having less than 5 percent material passing the No. 200 sieve. Because of their silt content, the native soils do not meet this requirement, and it will be necessary to import material to the project for wall backfill. Silty soils can be used for the last 18 to 24 inches of backfill, thus acting as a seal to the granular backfill. All backfill behind retaining walls should be moisture conditioned to within ± 2 percent of optimum moisture content and compacted to a minimum of 90 percent of the material's maximum dry density as determined in accordance with ASTM D1557. Fill materials should be placed in layers that, when compacted, do not exceed about 8 inches. Care in the placement and compaction of fill behind retaining walls must be taken in order to ensure that undue lateral loads are not placed on the walls. An adequate subsurface drain system will need to be designed and installed behind retaining walls to prevent hydrostatic buildup.

Slab-on-grade Floors

Support for lightly loaded floor slabs can be obtained on the undisturbed native soil or on engineered structural fill. A minimum 4-inch-thick layer of imported granular material should be placed and compacted over the prepared subgrade to assist as a capillary break and provide uniform load distribution.

A subgrade modulus of 150 pounds per cubic inch may be used to design floor slabs. Imported granular material should be crushed rock or crushed gravel and sand that is well-graded between coarse and fine, contain no deleterious materials, have a maximum particle size of 1½ inches, and have less than 5% by weight passing the U.S. Standard No. 200 Sieve. The imported granular material may be placed in one lift and should be compacted until well-keyed, about 95% of the maximum dry density as determined by ASTM D1557 (AASHTO T-180).

Pavement

The following pavement design recommendations are based on our experience with similar facilities and subgrade conditions.

For automobile parking areas, we recommend a pavement section consisting of 3 inches of asphaltic concrete (AC) over 8 inches of crushed rock base (CRB) or 5 inches of Portland Cement concrete (PCC) over 5 inches of crushed rock base (CRB). For truck traffic areas, the pavement section should consist of 4 inches of AC over 12 inches of CRB or 6 inches of PCC over 8 inches of CRB. These recommended pavement sections are based on the assumption that the subgrade consists of firm structural fill or compacted native subgrade and that the pavement will be constructed during the dry summer months. Proofrolling should be used to evaluate pavement subgrade. Any soft areas disclosed by proofrolling will likely need to be reworked. Some contingency should be provided for the repair of any soft areas. If pavement construction is scheduled for the wet season, it will be necessary to increase the above-recommended base course sections.

AC and CRB materials should conform to WSDOT specifications. All CRB should be compacted to at least 95 percent of the modified proctor ASTM D-1557 laboratory test standard.

<u>Drainage:</u> Permanent, properly installed drainage is also an essential aspect of pavement design and construction. All paved areas should have positive drainage to prevent ponding of surface water and saturation of the base course. This is particularly important in cut sections or at low points within the paved areas, such as around stormwater catch basins. Effective means to prevent saturation of the base course including installing weep holes in the sidewalls to catch basins.

<u>Geotextile Separation Fabric:</u> A geotextile separation fabric will be required at the interface of the native soil and imported subgrade material beneath the proposed roadways. The separation fabric should meet the specificiation provided in WSS 9-33.2(1) – Geotextile Properties (Table 3) for soil separation. The geotextile should be installed in conformance with the specifications provided in WSS 2-12 – Construction Geosynthetic.

<u>Stabilization Material:</u> In the case of unsuitable or unstable pavement subgrade conditions, stabilization material consisting of pit- or quarry-run rock or crushed rock should be placed below the above-described pavement sections. The material should have a maximum particle size of 6-inches and less than 5 percent by dry weight passing the U.S. Standard No. 4 sieve, have at least two mechanically fractured faces, and be free or organic matter or other deleterious material. Material meeting the specification provided in WSS 9-27.3(6) – Stone is generally acceptable for use. Stabilization material should be placed in lifts between 12 and 18 inches thick and compacted to a firm condition with a smooth-drum roller without using vibratory action.

Drainage and Groundwater Considerations

The Contractor should be made responsible for temporary drainage of surface water and groundwater as necessary during construction to prevent standing water and/or erosion at the site.

As a matter of good construction practice, we recommend that perimeter drains be installed for all buildings. Perimeter drains should consist of perforated drainpipe embedded in a zone of free draining fill that is wrapped in a non-woven geotextile filter. The pipe should be connected to a tightline drainpipe leading to storm drain facilities. Foundation and crawl space drainage should be sloped to drain to a sump or low point drain outlet. Water should not be allowed to pond within crawl spaces. Roof drains should be connected to a tightline drainpipe leading to storm drain outlet facilities.

Water should not be allowed to collect in the foundation excavations or on prepared subgrades for the foundations/slabs/roadway during construction. Positive site drainage should be maintained throughout construction activities. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff.

The site grading plan should be developed to provide rapid drainage of surface water away from the building areas and to inhibit infiltration of surface water around the perimeter of the buildings and beneath the floor slabs. The grades should be sloped away from the building area. We anticipate stormwater will be routed to the storm system (infiltration facility) to be constructed as part of this development.

Soil Erosion

Site-specific erosion control measures should be implemented to address the maintenance of slopes or exposed areas. This may include silt fence, bio-filter bags, straw wattles, or other suitable methods. During construction, all exposed areas should be well compacted and protected from erosion. Temporary slopes or exposed areas may be covered with straw, crushed aggregate, or rip in localized areas to minimize erosion.

LIMITATIONS

This report was prepared for the exclusive use of Pacific Lifestyle Homes and members of the design team for specific application to the Goodwin Road (Bahu) Property development located at the address noted above. It should be made available to prospective contractors for information on the factual data only, and not as a warranty of subsurface conditions such as those interpreted from the explorations and presented in the discussions of the subsurface conditions included in this report.

The recommendations contained in this report are based on information derived through subsurface sampling. No matter how effective subsurface sampling may be, variations between exploration location and the presence of unsuitable materials are possible and cannot be determined until exposed during construction. Accordingly, True North’s recommendations can be finalized only through True North's observation of the project's earthwork construction. True North accepts no responsibility or liability for any party's reliance on True North's recommendations.

Within the limitations of the scope, schedule and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no warranty, either express or implied.

CLOSING

We appreciate the opportunity to be of service to you. If you have any questions, or if we can be of further assistance to you, please contact us at (360) 984-6584.

Respectfully Submitted,

TIMOTHY JAMES NORTH
STATE OF WASHINGTON
48620
REGISTERED PROFESSIONAL ENGINEER

05/22/25

Timothy J. North, P.E.
Principal Geotechnical Engineer

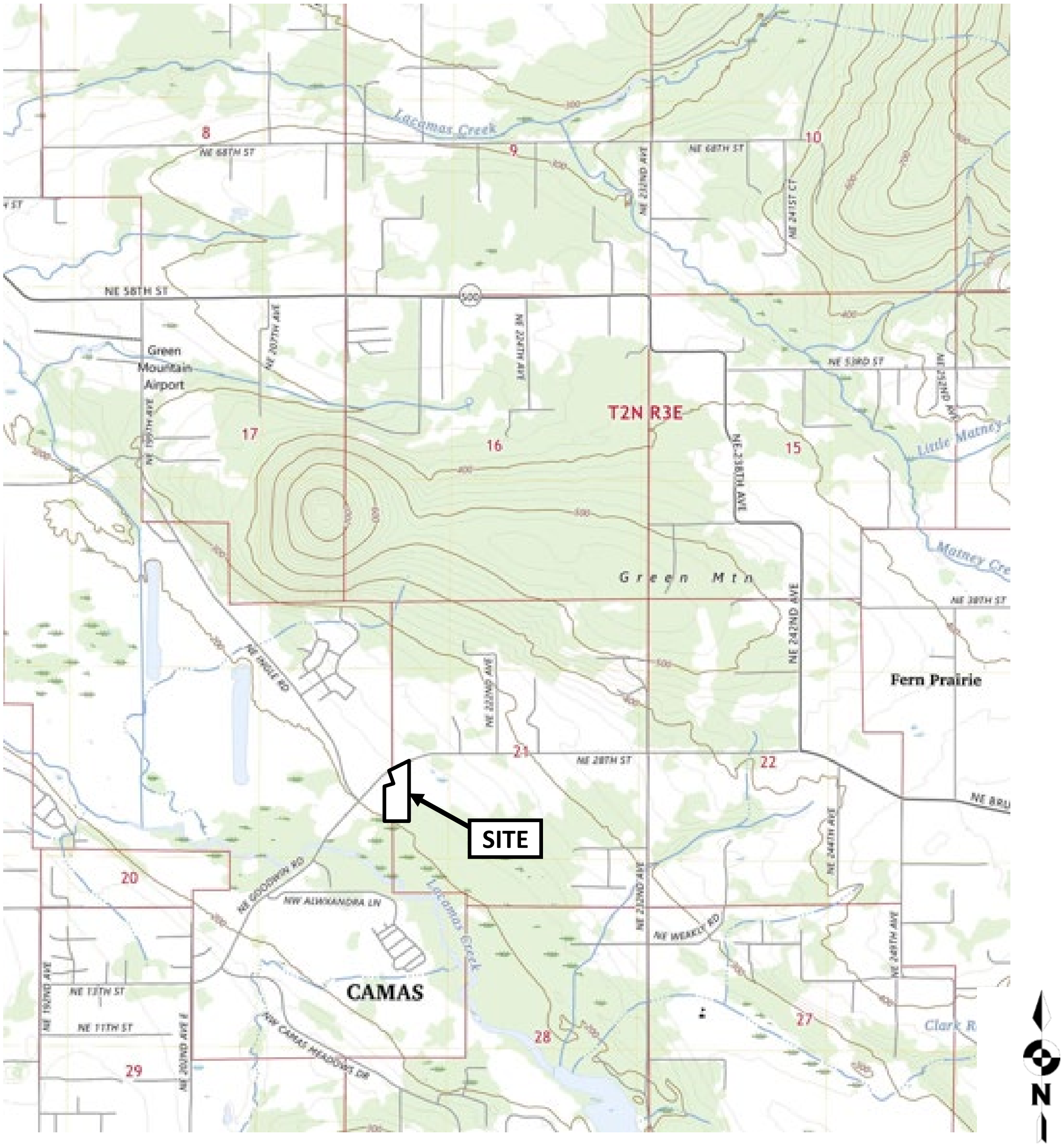
Reviewed By:

Lauren Shepherd, E.I.T.
Staff Geotechnical Engineer

Attachment: Figure 1 – Site Vicinity
Figure 2 – Site Layout and Explorations
Figure 3 – Site Photographs
Appendix A – Field Exploration Methods, Lab Testing Procedures, Exploration Logs

FIGURES

Exhibit 21 SUB25-1004



Not to
Scale

Source: “Topographic Map of the Lacamas Creek Quadrangle, 7.5 minute series” 2023, United States Geological Survey (USGS).

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Pacific Lifestyle Homes
Reserve at Green Mountain
Camas, Washington

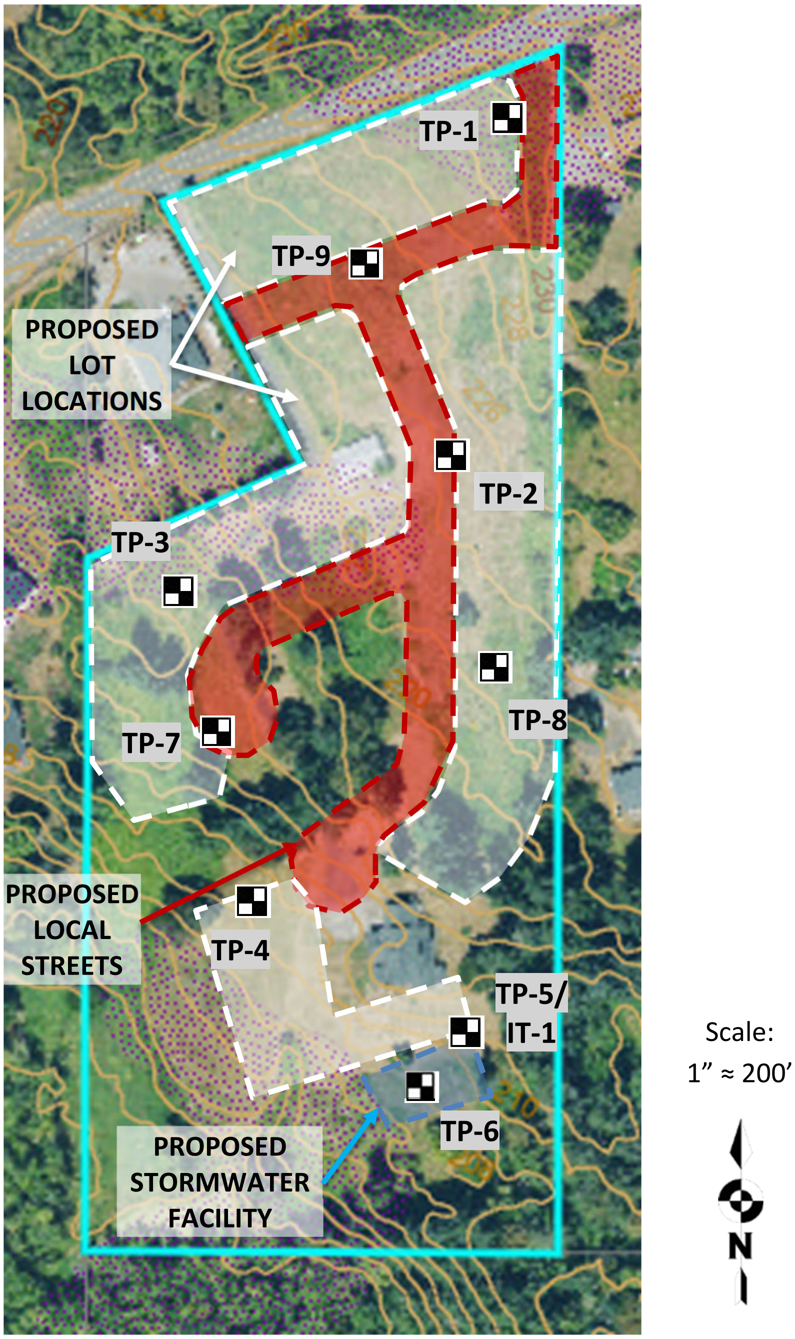
Project # 24-0368-2

219 West 4th Street
Vancouver, WA 98660
360-984-6584

April 2025

Figure 1 – Vicinity Map

Exhibit 21 SUB25-1004



▚ **TP-1** Approximate Exploratory Test Pit Locations, November 4, 2024, and March 21, 2025.

Source: Aerial & Topo – Clark County MapsOnline, accessed November 18, 2024.

Note: Purple shading indicates mapped hydric soils.

TRUE NORTH ◆ GEOTECHNICAL ◆	Pacific Lifestyle Home Reserve at Green Mountain Camas, Washington	Project # 24-0368-2
219 West 4th Street Vancouver, WA 98660 360-984-6584	April 2025 (revised May 2025)	Figure 2 –Site Plan

Photo 1. From the approximate location of TP-1, looking west across the pasture.

Photo 2. From between the two outbuildings, looking north along the private driveway connecting with NE Goodwin Road.

TRUE NORTH GEOTECHNICAL	Pacific Lifestyle Homes Reserve at Green Mountain Camas, Washington	Project # 24-0368-2
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Photo 3. From between the existing outbuildings, looking south, towards the existing residence.

Photo 4. From approximate location of TP-3, looking east towards existing outbuildings.

TRUE NORTH GEOTECHNICAL	Pacific Lifestyle Homes Reserve at Green Mountain Camas, Washington	Project # 24-0368-2
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Photo 5. From approximate location of TP-4, looking southeast towards existing residence.

Photo 6. From the existing residence, looking west across gentle descending slope to proposed open recreational area.

TRUE NORTH GEOTECHNICAL	Pacific Lifestyle Homes Reserve at Green Mountain Camas, Washington	Project # 24-0368-2
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Photo 1. South of the existing residence, looking east, towards the location of TP-6

Photo 2. From the existing driveway, looking southwest towards the existing residence and TP-7, in progress

TRUE NORTH GEOTECHNICAL	Pacific Lifestyle Homes Reserve at Green Mountain Camas, Washington	Project # 24-0368-2
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Exhibit 21 SUB25-1004

Photo 3. From north of the existing residence, looking north, towards the location of TP-8

Photo 4. From near the existing barn, looking north towards TP-9, in progress

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April 2025

Figure 3E – Site Photographs
(5 of 5)

APPENDIX A

Field Exploration Procedures
Laboratory Testing Procedures
Test Pit Logs

FIELD EXPLORATION PROCEDURES

General

We excavated a total of 9 test pits (TP-1 through TP-9) to depths ranging between 4.5 and 11 feet below existing ground surface (bgs) across the proposed development area. The excavations were advanced utilizing a Link-Belt 80 X3 with a 30-inch wide toothed bucket owned and operated by Thompson Brothers Excavating. Soil samples were collected from the major strata encountered in each test pit and at the bottom of each infiltration test pit location The approximate exploration locations are shown in Figure 2.

Soil Sampling

Representative grab samples of the soil observed in the explorations were obtained from the sidewalls or spoils. Samples obtained in the exploration were sealed in airtight, plastic bags to retain moisture and returned to our laboratory for additional examination and testing. The test explorations were loosely backfilled.

Pocket Penetrometer Testing

The undrained shear strength of fine-grained soil (silt and clay) was estimated with a pocket penetrometer applied to the sidewalls of the test pits. A pocket penetrometer is a hand-held device that indicates undrained compressive strength in tons per square foot. The test method is approximate and applicable only to fine-grained soil.

Field Classification

Soil samples were initially classified visually in the field. Consistency, color, relative moisture, degree of plasticity, peculiar odors, and other distinguishing characteristics of the soil samples were noted. The terminology used is described in the key and glossary that follow.

Summary Exploration Logs

Results from the explorations are shown in the summary exploration logs. The left-hand portion of a log provides our interpretation of the soil encountered, sample depths, and groundwater information. The right-hand, graphic portion of a log shows the results of pocket penetrometer and laboratory testing. Soil descriptions and interfaces between soil types shown in summary logs are interpretive, and actual transitions may be gradual.

LABORATORY TESTING PROCEDURES

Soil samples obtained during field explorations are examined in our laboratory, and representative samples may be selected for further testing.

Visual-Manual Classification

Soil samples are classified in general accordance with guidelines presented in ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The physical characteristics of the samples are noted and the field classifications are modified, where necessary, in accordance with ASTM terminology, though certain terminology that incorporates current local engineering practice may be used. The term which best described the major portion of the sample is used to describe the soil type.’

Natural Moisture Content

Natural moisture content is determined in general accordance with guidelines presented in ASTM D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. The natural moisture content is the ratio, expressed as a percentage, of the weight of water in a given amount of soil to the weight of solid particles.

Fines Content

Fines content testing is performed in general accordance with guidelines presented in ASTM D1140, *Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No.200) Sieve in Soils by Washing*. The fines content is the fraction of soil that passes the U.S. Standard Number 200 Sieve. This sieve differentiates fines (silt and clay) from sand and gravel. Soil material that remains on the Number 200 sieve is sand. Material that passes the sieve is fines. The test is used to refine soil type.

Exhibit 21 SUB25-1004

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TABLE A1
Key to Test Pit and Boring Terminology and Symbols

MAJOR DIVISIONS				SYMBOLS		TYPICAL DESCRIPTION
				GRAPH	LETTER	
Coarse Grained Soils	More Than 50% Material Retained on No. 200 Sieve	Gravel and Gravelly Soils More Than 50% Coarse Fraction Retained on No. 4 Sieve	Clean Gravels (Little or No Fines)	○	GW	Well-graded Gravels, Gravel-Sand Mixtures, Little or No Fines
				⬡	GP	Poorly-graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			Gravels with Fines (Significant Percentage of FInes)	▥	GM	Silty Gravels, Gravel-Sand-Silt Mixtures
				▨	GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
		Sand and Sandy Soils More Than 50% Coarse Fraction Passing No. 4 Sieve	Clean Sands (Little or No Fines)	░	SW	Well-graded Sands, Gravelly Sands, Little or No Fines
				░	SP	Poorly-graded Sands, Gravelly Sands, Little or No Fines
			Sands with Fines (Significant Percentage of FInes)	▥	SM	Silty Sands, Sand-Silt Mixtures
				▨	SC	Clayey Sands, Sand-Clay Mixtures
Fine Grained Soils	More Than 50% Material Passing No. 200 Sieve	Silts and Clays	Liquid Limit Less than 50 percent	▥	ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty-Clayey Fine Sands, Clayey Silts
				▨	CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays
				▤	OL	Organic Silts and Organic Silty Clays of Low Plasticity
		Silts and Clays	Liquid Limit Greater than 50 percent	▥	MH	Inorganic Silts Micaceous or Diatomaceous Fine Sand or Silty Soils
				▨	CH	Inorganic Clays of High Plasticity, Fat Clays
				▨	OH	Organic Clays of Medium to High Plasticity, Organic Silts
				+	PT	Peat, Humus, Swamp Soils
Topsoil				░		Humus and Duff Layer
Fill				▩		Highly Variable Constituents

Relative Density of Coarse-Grained Soils	
Relative Density	**N - Blows per Foot**
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50+

Consistency of Fine-Grained Soils	
Relative Density	**N - Blows per Foot**
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 -8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	30 - 50
Very Hard	50+

Key to Sampler Type Symbols

G	⊠	◫	▥	▮
Grab	SPT	Shelby Tube	Dames & Moore	Rock Core

Exhibit 21 SUB25-1004

True North Geotechnical

219 W. 4th Street Vancouver, WA 98660

Phone: (360) 984-6584

Geotechnical Log - Test Pit

TP-1

UTM	: 10T	Excavator	: Link-Belt	Job Number	: 24-0368-1
Latitude	: 45.58570	Excavator Supplier	: Thompson Brothers Excavating	Client	: Pacific Lifestyle Homes
Longitude	: -122.40267	Logged By	: LS	Project	: Goodwin Road (Bahu Property)
Ground Elevation	: Not Surveyed	Reviewed By	: TJN	Location	: Camas, Washington, USA
Total Depth	: 10 ft BGL	Date	: 11/04/2024	Loc Comment	:

Depth (ft)	Sample No.	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Pocket Pen (TSF)	Notes
1 2	S1		ML	Soft, dark brown, SILT, some clay; rooted to 8 inches bgs; slightly moist.	32		1.0 0.75	
3 4 ▼5	S2		CL-ML	Soft to medium stiff, red brown, CLAYEY SILT, some sand; very moist.	24	70	1.5 1.5	
6 7 8	S3		SM	Medium dense to dense, gray brown, POORLY GRADED SILTY SAND; wet.	41	49		
9	S4		GP-GC	Dense, tan gray, POORLY GRADED GRAVEL AND BOULDERS, some clay; boulders up to 22 inches in diameter; wet.	55			

Groundwater encountered at 5 feet bgs. Test pit backfilled with excavated soils and tamped to grade.

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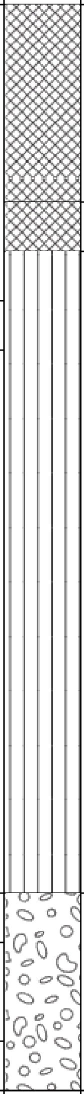
True North Geotechnical
219 W. 4th Street Vancouver, WA 98660
Phone: (360) 984-6584

Geotechnical Log - Test Pit

TP-2

UTM	**: 10T**	**Excavator**	**: Link-Belt**	**Job Number**	**: 24-0368-1**
Latitude	**: 45.58570**	**Excavator Supplier**	**: Thompson Brothers Excavating**	**Client**	**: Pacific Lifestyle Homes**
Longitude	**: -122.40267**	**Logged By**	**: LS**	**Project**	**: Goodwin Road (Bahu Property)**
Ground Elevation	**: Not Surveyed**	**Reviewed By**	**: TJN**	**Location**	**: Camas, Washington, USA**
Total Depth	**: 11 ft BGL**	**Date**	**: 11/04/2024**	**Loc Comment**	**:**

Depth (ft)	Sample No.	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Pocket Pen (TSF)	Notes
0				Fill- soft to medium stiff, red brown, SILT, some clay; rooted to 8 inches bgs; moist.				
2				Fill- dense, gray, POORLY GRADED GRAVEL; moist.				
2.5			CL-ML	Soft to medium stiff, dark blue-gray to black, SILTY CLAY; moist to very moist.				
3	S1				26	68	2.5	
4							1.5	
8.5 ▼								
9	S2		GW	Medium dense to dense, dark blue-gray, WELL-GRADED GRAVEL AND COBBLES WITH SAND; cobbles up to 8 inches in diameter; wet.	30			
10.5	S3				39			

Groundwater encountered at 8.5 feet bgs. Test pit backfilled with excavated soils and tamped to grade.

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True North Geotechnical

219 W. 4th Street Vancouver, WA 98660
Phone: (360) 984-6584

Geotechnical Log - Test Pit

TP-3

UTM : 10T
Latitude : 45.58570
Longitude : -122.40267
Ground Elevation : Not Surveyed
Total Depth : 4.5 ft BGL

Excavator : Link-Belt
Excavator Supplier : Thompson Brothers Excavating
Logged By : LS
Reviewed By : TJN
Date : 11/04/2024

Job Number : 24-0368-1
Client : Pacific Lifestyle Homes
Project : Goodwin Road (Bahu Property)
Location : Camas, Washington, USA
Loc Comment :

Depth (ft)	Sample No.	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Pocket Pen (TSF)	Notes
1			ML	Soft to medium stiff, dark brown, SILT, some clay; rooted to 6 inches bgs; moist.			2.0	
2				Stiff, red brown, SILTY CLAY WITH GRAVEL AND BOULDERS; with boulders up to 3 feet in diameter; moist.			1.0	
3	S1		CL-ML		15	69	2.0	
4							4.5+	
				Refusal due to practical equipment failure. No groundwater encountered. Test pit backfilled with excavated soils and tamped to grade.				

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True North Geotechnical
219 W. 4th Street Vancouver, WA 98660
Phone: (360) 984-6584

Geotechnical Log - Test Pit

TP-4

UTM	: 10T	**Excavator**	: Link-Belt	**Job Number**	: 24-0368-1
Latitude	: 45.58570	**Excavator Supplier**	: Thompson Brothers Excavating	**Client**	: Pacific Lifestyle Homes
Longitude	: -122.40267	**Logged By**	: LS	**Project**	: Goodwin Road (Bahu Property)
Ground Elevation	: Not Surveyed	**Reviewed By**	: TJN	**Location**	: Camas, Washington, USA
Total Depth	: 6.5 ft BGL	**Date**	: 11/04/2024	**Loc Comment**	:

Depth (ft)	Sample No.	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Pocket Pen (TSF)	Notes
			ML	Soft to medium stiff, dark brown, SILT, some clay; rooted to 6 inches bgs; moist.				
1	S1				24	57	1.0	
2			SC	Stiff, gray brown with red mottling, SANDY CLAY WITH GRAVEL, some cobbles; slightly moist.			1.5	
	S2				19			
3							4.5+	
4							4.5+	
5			SP	Medium dense, red brown, POORLY GRADED SAND, some clay; very moist.				
	S3				37	39		
▼6								

Groundwater encountered at 6 feet bgs. Test pit backfilled with excavated soils and tamped to grade.

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True North Geotechnical

219 W. 4th Street Vancouver, WA 98660

Phone: (360) 984-6584

Geotechnical Log - Test Pit

TP-5

UTM	: 10T	Excavator	: Link-Belt	Job Number	: 24-0368-1
Latitude	: 45.58570	Excavator Supplier	: Thompson Brothers Excavating	Client	: Pacific Lifestyle Homes
Longitude	: -122.40267	Logged By	: LS	Project	: Goodwin Road (Bahu Property)
Ground Elevation	: Not Surveyed	Reviewed By	: TJN	Location	: Camas, Washington, USA
Total Depth	: 6.5 ft BGL	Date	: 11/04/2024	Loc Comment	:

Depth (ft)	Sample No.	Graphic Log	USCS Symbol	Soil Description	Water Content (%)	Fines Content (%)	Pocket Pen (TSF)	Notes
			ML	Medium stiff, dark brown, SILT, some clay; rooted to 4 inches bgs; moist.				
1	S1				21		2.0	
2							1.5	
3			GM	Dense, gray, SILTY GRAVEL; slightly moist.			4.5+	
			CL-ML	Stiff, red brown with gray and red mottling, SILTY CLAY; dry to slightly moist.				
4							4.5+	
	S2				22	53		Infiltration testing completed at 4.5 feet bgs
5								
	S3				16			
6			GM	Very dense, gray brown, SILTY GRAVEL AND BOULDERS; with boulders up to 24 inches in diameter; dry to slightly moist.				

Terminated due to practical equipment refusal. Groundwater not encountered.
Test pit backfilled with excavated soils and tamped to grade.

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APPENDIX D

Operations and Maintenance Manual

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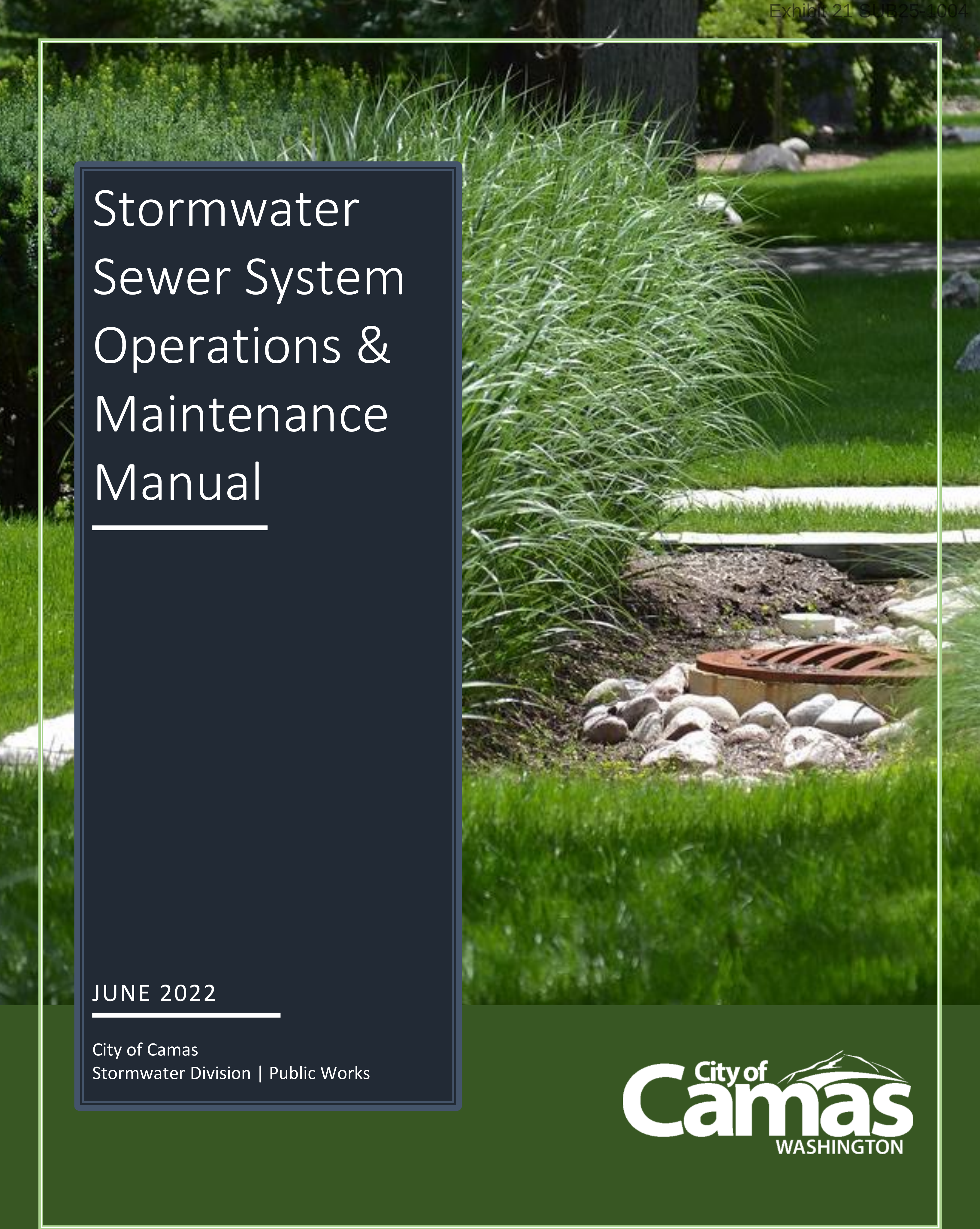

Stormwater Sewer System Operations & Maintenance Manual

JUNE 2022

City of Camas
Stormwater Division | Public Works

City of Camas
WASHINGTON

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Introduction

Background

All public and privately owned, roads, parking lots, residential developments, commercial or industrial developments, or school facilities have various components that make up a storm system. These components consist of conveyance pipes, catch basins, manholes, roadside ditches, stormwater facilities (such as bioswales, detention ponds, wet ponds, treatment filters, etc.), landscaping and any other structure that collects, conveys, controls, and/or treats stormwater. Regardless of the component, all storm systems eventually discharge into 'waters of the state' which are streams, rivers, lakes, and wetlands.

Under the Federal Clean Water Act (FCWA) and in compliance with the Department of Ecology's NPDES Phase II Permit, 'waters of the state' are to be protected from contamination. This in turn protects threatened and endangered species under the Federal Endangered Species Act (FESA).

One way to protect 'waters of the state' is to provide the proper maintenance of all storm system components. It is the responsibility of the City of Camas (City) to ensure that all components of the public storm system be properly maintained and operated. The City is responsible for those components that are located within the City's right-of-way, such as the conveyance pipes, manholes, catch basins, roadside ditches, and stormwater facilities. A large part of the stormwater facilities in the City are privately owned and maintained by the property owners. These property owners include, but are not limited to, Homeowners Associations (HOAs), school district, businesses, and commercial/industrial site owners.

Purpose

This manual is intended to help, both public and private stormwater facility maintenance operators, meet the requirements of City Municipal Code 14.02.090 for proper maintenance and operation of the various storm system components. Proper maintenance will help to assure that:

- Stormwater facilities operate as they were designed;
- Storm systems are cleaned of the pollutants that they trap, such as sediment and oils, so that storm systems are not overwhelmed and become pollutant sources;
- Pollutant sources are removed, or minimized, prior to entering the storm system.

Along with keeping a site from flooding, properly maintained storm system can help reduce surface water and groundwater pollution. Most sites have some type of stormwater control component designed to limit the environmental and flooding damage caused by stormwater runoff. These components require more labor intensive maintenance than a system of pipes and catch basins.

Manual Layout

This manual is broken out into various best management practice (BMP) maintenance components. For each BMP maintenance component, this manual will:

- Briefly describe the component type, e.g. facility or activity.
- Describes potential maintenance issues and/or problems.
- Describes conditions when maintenance is required.
- Minimum performance standards and suggested maintenance methods.

Additional information may be found in other manuals, such as the Washington Department of Ecology's *Stormwater Management Manual for Western Washington (SWMMWW), Vols. V*, and Ecology's LID manual.

Inspection of a stormwater facility will determine if conditions require a maintenance action. The maintenance standard is not the required condition at all times. Exceeding a condition, between inspections and/or maintenance, does not automatically constitute a violation of these standards. The inspection and maintenance schedules should be adjusted to minimize the length of time that a facility is in a condition that requires maintenance.

Emergent Treatment Technologies

Some stormwater treatment facilities are designed and installed with emerging technologies that are not standard at the time of their installation. If not found in this manual, a treatment facility may be an emerging technology approved by Washington Department of Ecology; the maintenance standards can be found at Emerging Stormwater Treatment Technologies.

Mosquito Control

Mosquitoes are annoying and sometimes pose a serious risk to public health. They can transmit diseases such as West Nile Virus and equine encephalitis. Above-ground stormwater facilities should be designed to allow water to flow through or infiltrate in less than 48 hours. Presence of mosquitos in a stormwater facility may indicate a clogged outlet, compromised infiltration capacity, or other defect that should trigger inspection and may require maintenance.

If mosquitos are identified during a stormwater facility maintenance or inspection and are a concern, a request to the Clark County Mosquito Control District for service or information regarding mosquito control can be made online at Mosquito Control District or at the 24-hour request line, 360-397-8430.

Material Disposal and Spills

The disposal of waste, e.g. sediment or standing water, from the maintenance of the stormwater facilities and storm system components shall be conducted in accordance with federal, state, and local regulations, including the Solid Waste Handling Standards chapter 173-350 WAC, Minimum Functional Standards for Solid

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Waste Handling chapter 173-304 WAC and Appendix IV-B: Management of Street Waste Solids and Liquids of the SWMMWW. Dangerous waste must be handled following, Dangerous Waste Regulations chapter 173-303 WAC. Vegetation to be recycled and disposed of at local receptacle locations.

For major spills, coordinate removal/cleanup with the City at 360-817-1563 and notify Department of Ecology at 360-407-6300.

Vegetated Facilities

Biofiltration Swale

Biofiltration swales use grass or other dense vegetation to filter sediment and oily materials out of stormwater. Usually, they look like flat-bottomed channels with grass growing in them. As water passes through the vegetation, pollutants are removed through the effects of filtration, infiltration and settling.

See SWMMWW Appendix V-A, Table V-A.8 for biofiltration swale maintenance standards. If available, reference record drawings for seed mix and groundcover replacements, or see SWMMWW BMP T9.10, Tables V-7.3 and V-7.4. Presence of cattails is a sign that that there is water ponding and the facility is not functioning as design. Cattails will need to be removed and further investigation may be required.

Wet Biofiltration Swale

A wet biofiltration swale is a variation of basic biofiltration swale for use where the centerline slope is slight, groundwater table are high, or a continuous low base flow is likely to result in wet soil conditions for long periods of time. Where continuously wet soil exceeds about 2 weeks, typically grasses will die. Thus, vegetation specifically adapted to wet soil conditions is needed. Different vegetation requires modification of several of the design and maintenance requirements from the basic biofiltration swale.

See SWMMWW Appendix V-A, Table V-A.9 for wet biofiltration swale maintenance standards. If available, reference record drawings for seed mix and groundcover replacements, or see SWMMWW BMP T9.20, Table V-7.5. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

Filter Strip

Filter strips are linear strips of grass that remove sediment and oils from stormwater by filtering it. Stormwater is treated as it sheet flows across the filter strip. Usually, filter strips are placed along the edge of linear paved areas, such as parking lots and roads. Where designed filter strips are installed; road shoulders should only be graded to maintain level flow off the road.

See SWMMWW Appendix V-A, Table V-A.10 for filter strip maintenance standards. If available, reference record drawings for seed mix replacement, or see SWMMWW BMP T9.10, Table V-7.3.

Detention Pond

Detention pond facilities are designed to hold and slowly release stormwater by use of a pond with a specially designed control structure. Styles vary greatly from well-manicured to natural appearing. Generally, native vegetation is preferred for reduced maintenance and enhance wildlife habitat. Some facilities are designed to appear as natural water bodies or are in a park-like setting.

See SWMMWW Appendix V-A, Table V-A.1 for detention pond maintenance standards. If available, reference record drawings for seed mix replacement, or see SWMMWW BMP D.1, Table V-12.3. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

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Wet Pond

A wet pond is an open basin that retains a permanent pool of water year-round or only during the wet season. The volume of the wet pond allows sediment and other pollutants to settle out of the runoff. Wetland vegetation is typically planted within the wet pond to provide additional treatment through nutrient removal. Detention quantity control can be provided with additional temporary storage volume above the permanent pool elevation.

See SWMMWW Appendix V-A, Table V-A.11 for wet pond maintenance standards. If available, reference record drawings for seed mix and plants replacement, or see SWMMWW BMP D.1, Table V-12.3 for seed mix and BMP T10.10, Table V-8.1 for plants. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

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Infiltration Facility

Infiltration facilities dispose of water by holding it in an area where it can soak into the ground. These are open facilities that may either drain rapidly and have grass bases or have perpetual ponds where water levels rise and fall with stormwater flows. Infiltration facilities may be designed to handle all of the runoff from an area or they may overflow and bypass larger storms.

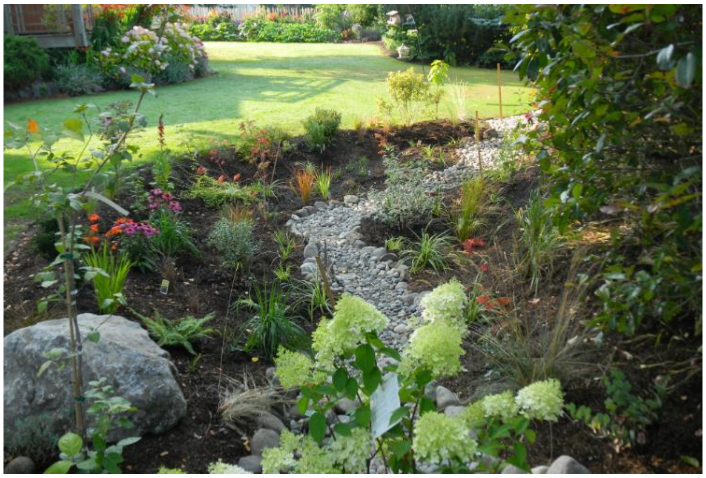
Since the facility is designed to pass water into the ground, generally after passing through a sediment trap/manhole, anything that can cause the base to clog will reduce the performance and is a large concern. Generally, infiltration basins are managed like detention ponds, but with greater emphasis on maintaining the capacity to infiltrate stormwater.

See SWMMWW Appendix V-A, Table V-A.2 for infiltration facility maintenance standards. If available, reference record drawings for seed mix replacement, or see SWMMWW BMP D.1, Table V-12.3. Removal of cattail is required when vegetation is crowded out by very dense clumps of cattails, prevents water flow, or alters the designed functionality.

Rain Garden

Rain gardens are non-engineered, shallow, landscaped depressions with compost-amended soils and adapted plants. The depression temporarily stores stormwater runoff from adjacent areas. Some or all the influent stormwater passes through the amended soil profile and into the underlying native soil. Stormwater that exceeds the storage capacity is designed to overflow to an adjacent drainage system.

If available, reference record drawings for plant replacements, or see Rain Garden Handbook for Western Washington, Appendix A for recommendation on rain garden plants. Presence of cattails is a sign that that there is water ponding and the facility is not functioning as design. Cattails will need to be removed and further investigation may be required.



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Rain Garden			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Trash and Debris	Evidence of trash and debris	Remove trash and debris
Side slopes	Erosion	Persistent soil erosion on slopes	Replenish mulch areas throughout rain garden - on the sides and bottom of the rain garden and around the perimeter (and on berm if applicable).
Bottom area	Sediment	Visible sediment that reduces drainage rate	Remove sediment accumulation
		Sediment deposited from water entering the rain garden	Remove sediment, determine the source, and stabilize area
	Leaves	Matted accumulation of leaves reducing drainage rate	Remove leaves
Ponded water	Ponding	Ponded water remains for more than 3 days after the end of a storm	Remove sediment, leaf litter and/or debris accumulation
Pipe inlet/outlet	Pipe	Water is backing up in pipe	Clear pipes of sediment and debris with snake and/or flush with water
		Damaged or cracked drain pipes	Repair or seal cracks, or replace as needed
Inlet rock pad	Erosion	Rock or cobble is removed, missing and flow is eroding soil.	Replace rock and reestablish pad
Weeds	Weeds	Weeds are present	Remove weeds and apply mulch after weeding
Vegetation	Dying Vegetation	Dying, dead or unhealthy plants	Remove diseased plants or plant parts and dispose, then replace
	Sight Distance	Vegetation reduces sight distances and sidewalk	Keep sidewalks and sight distances on roadways clear
	Blockage	Vegetation is crowding inlets and outlets	Remove vegetation crowding inlets and outlets
	Poor Vegetation Growth	Yellowing, poor growth, poor flowering, spotting or curled leaves, weak roofs, or stems	Test soil to identify specific nutrient deficiencies.
			Do not use synthetic fertilizers
			Consider selecting different plant for soil conditions
Mulch	Bare Soil	Bare spots are present or mulch depth less than 2 inches	Supplement mulch with hand tools to a depth of 2 to 3 inches, keep mulch away from woody stems.

Bioretention

Bioretention facilities are engineered facilities that store and treat stormwater by filtering it through a specified soil profile. Water that enters the facility ponds in an earthen depression or other basin (e.g., concrete planter) before it infiltrates into the underlaying bioretention soil. Stormwater that exceeds the surface storage capacity overflow to an adjacent drainage system. Treated water is either infiltrated into the underlying native soil or collected by an underdrain and discharged. An underdrain system can be comprised of perforated or slotted pipe, wrapped in an aggregate blanket.

See SWMMWW Appendix V-A, Table V-A.21 for bioretention maintenance standards. If available, reference record drawings for plant replacements, or see LID Technical Guidance Manual for Puget Sound, Appendix 1 for plant recommendations. Presence of cattails is a sign that that there is water ponding and the facility is not functioning as design. Cattails will need to be removed and further investigation may be required.

Conveyance Ditch

Ditches are often manmade open-channels that convey stormwater runoff. These ditches are maintained to prevent localized flooding.

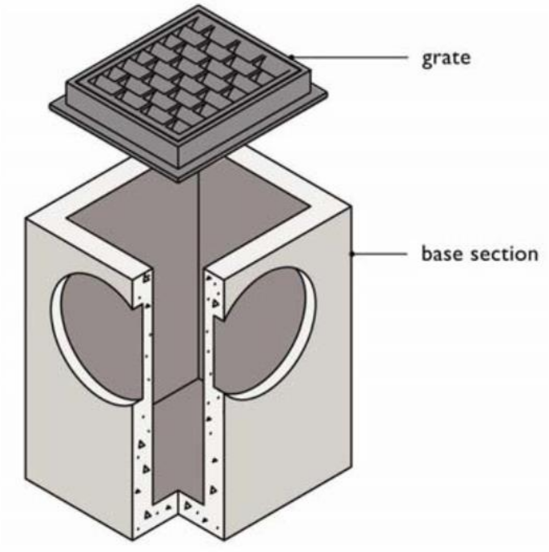
Conveyance Ditch			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Sediment	Sediment exceeds 20% of ditch depth or affects the historic or designed hydraulic capacity.	Remove sediment deposits. When finished, ditch should be level from side to side and drain freely in intended direction.
	Standing Water	Excessive standing water in ditch between storms due to ditch not draining freely	If possible, repair cause of poor drainage. This may include but is not limited to the following activities: remove sediment or trash blockages, improve grade of ditch.
	Eroded or Unstable Side Slopes	When grass is sparse, bare or eroded, patches occur in more than 20% of the ditch	Determine why grass growth is poor and correct that condition. Replant with plugs of grass at eight-inch intervals or reseed. If cause is excessive moisture replace grass with wetland plantings.
	Vegetation	Grass is excessively tall (greater than 15 inches). Nuisance weeds and other vegetation start to take over ditch.	Mow vegetation and/or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches.
	Bare Soil	Poor vegetation coverage.	Reseed poor vegetation areas. Reference "Low Grow" seed mix, see SWMMWW BMP C120 Table II-3.4
	Inlet/Outlet Pipes or Culverts	Inlet/outlet area clogged with sediment and/or debris	Remove material so that there is no clogging or blockage in the inlet and outlet area
	Trash and Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Remove trash and debris from ditch.
	Erosion/Scouring	Eroded or scoured ditch bottom	Permanently stabilize ditch bottom

Stormwater Structures

Catch Basin

A catch basin is an underground concrete structure with a slotted grate that collects stormwater runoff and route it through the underground pipes. Catch basins typically provide a sump below the outlet pipe to allow sediment and debris to settle out of the stormwater runoff. Some catch basins are fitted with a spill control device such as an inverted elbow on the outlet pipe to control grease or oils. The most common tool for cleaning catch basins is a vactor truck which is used to remove sediment and debris from the sump. The sediment and oils if not removed from the catch basins have the potential to pollute downstream waterbodies. Unless you have Occupational Safety and Health Administration (OSHA) approved confined space training and equipment, never enter a catch basin. There is a considerable risk of poisonous gas and injury.

See SWMMWW Appendix V-A, Table V-A.5 for catch basin maintenance standards.



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Field/Ditch Inlet

An inlet is a concrete, plastic or steel structure fitted with a slotted grate to collect stormwater runoff and route through underground pipes. A field inlet has a flat grate, and a ditch inlet has an angled grate. These inlets typically provide a sump below the outlet pipe to allow sediment and debris to settle out of the stormwater runoff. Some of these inlets are fitted with a spill control device such as an inverted elbow on the outlet pipe to control grease or oils. The most common tool for cleaning out the inlet is a vactor truck which is used to remove sediment and debris from the sump. The sediment and oils if not removed from the inlet has the potential to pollute downstream water bodies. Unless you have OSHA approved confined space training and equipment, never enter an inlet. There is a considerable risk of poisonous gas and injury.

Field Inlet

Ditch Inlet

Field Inlet/Ditch Inlet

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Trash & Debris	Trash or debris blocking inletting capacity by more than 10%.	Remove trash or debris blocking grate opening.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	Remove dead animals or vegetation present within the field/ditch inlet.
	Sediment	Sediment has accumulated to within six inches of the invert of the lowest pipe	Remove sediment
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch.	Repair top slab to be free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Make adjustments so that frame is sitting flush on the riser rings or top slab and is firmly attached.
	Fractures or Cracks in Field Inlet Walls/Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Regrout pipe and secure at field inlet wall.
	Settlement/ Misalignment	If failure of field inlet has created a safety, function, or design problem.	Replace or repair field inlet to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the inlet opening.	Remove vegetation blockage from basin opening.
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.
Metal Grates	Grate Not in Place	Grate is missing or only partially in place. Any open field inlet requires maintenance.	Replace missing grate, cover field inlet
	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Repair grate opening
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Replace missing grate or repair broken member(s)

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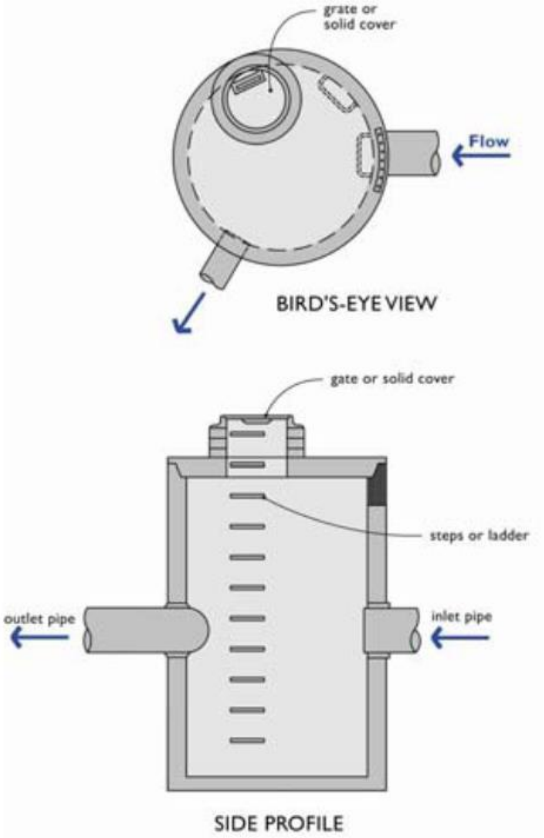
Manhole

Manholes are large cylindrical underground structures usually set at storm sewer pipe connections. Manholes are used in storm sewer system at any change in direction, slope, pipe material or pipe size. Some manholes have sumps and fitted with stormwater flow control structures such as orifices or weirs. Unless you have OSHA approved confined space training and equipment, never enter a manhole. There is a considerable risk of poisonous gas and injury.

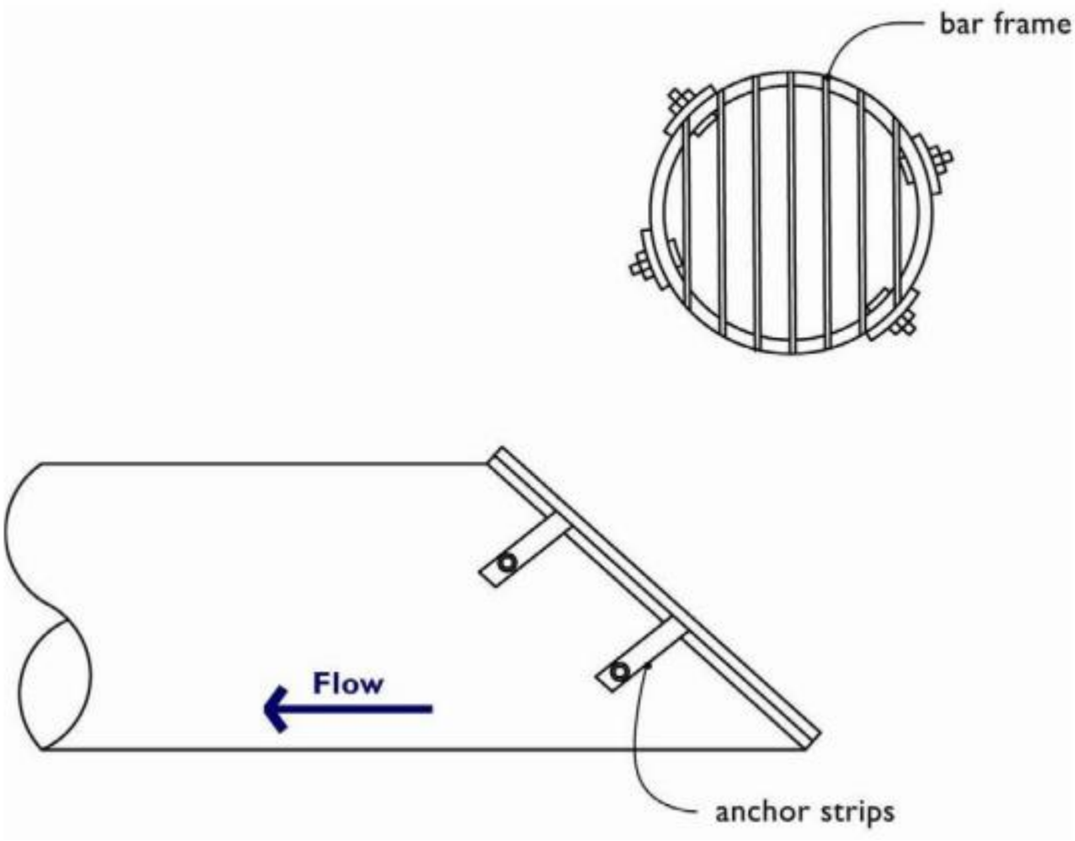


Manhole			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Trash and Debris	Trash or debris has accumulated to within six inches of the invert of the lowest pipe.	Remove all trash or debris from manhole.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Remove trash or debris from inlet and outlet pipes.
	Sediment	Sediment has accumulated to within six inches of the invert of the lowest pipe.	Remove all sediment from manhole
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch.	Repair top slab to be free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Make adjustments so that frame is sitting flush on the riser rings or top slab and is firmly attached.
	Fractures or Cracks in Manhole Walls/Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering manhole through cracks.	Regrout pipe and secure at manhole wall.
	Settlement/ Misalignment	If failure of manhole has created a safety, function, or design problem.	Replace or repair manhole to design standards.
Cover	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Replace missing cover, cover manhole.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Repair opening mechanism
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure.	Make adjustments so that one maintenance person can remove the manhole cover.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Repair or replace ladder to meet design standards and allow maintenance person safe access.
Control Structure/Flow Restrictor	See Control Structure/Flow Restrictor		

Debris Barrier

Debris barriers and trash racks are barred covers to pipe openings. They prevent large objects from entering pipes and keeps pets and people out of the pipes as well.

See SWMMWW Appendix V-A, Table V-A.6 for debris barrier maintenance standards.



Profile View

Sediment Trap

A sediment trap is a concrete structure typically fitted with slotted grate or multiple slotted grates. The concrete structure provides a storage volume (sump) below the outlet pipe to allow sediment and debris to settle out of the stormwater runoff. A sediment trap can be a fully enclosed concrete structure (above or below ground) with a sump, inlet pipe(s) and outlet pipe.

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Sediment Trap			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Trash and Debris	Trash and debris which is located immediately in front of the sediment trap opening or is blocking the inlet capacity of the basin by more than 10%	Remove trash and debris
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	Remove dead animals or vegetation present within the sediment trap.
	Sediment (non-enclosed structure)	Sediment depth exceeds 2 inches.	Remove sediment
	Sediment (enclosed structure)	Sediment depth within 6 inches from lowest invert	Remove sediment
	Fractures or Cracks in Sediment Trap	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering sediment trap through cracks.	Regrout pipe and secure at sediment trap wall.
	Settlement/ Misalignment	If failure of sediment trap has created a safety, function, or design problem.	Replace or repair sediment trap to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the sediment trap opening	Remove vegetation
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove contaminants and/or pollutants. (Coordinate removal/cleanup with local water quality response agency)
Slotted Grate	Trash and Debris	Trash and debris that is blocking more than 20% of the grate surface inlet capacity	Remove trash and debris from grate
	Damaged or Missing Grate	Grate missing or broken member(s) of the grate	Replace or repair grate to design standards.
Cover (enclosed structure)	Cover Not in Place	Cover is missing or only partially in place.	Replace missing cover
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure or latch broken	Make adjustments so that one maintenance person can remove the cover and/or repair broken latch.

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Energy Dissipater

Energy dissipaters are critical for preventing erosion at storm drain outfalls. There are a variety of designs, including wire gabion baskets, rock splash pads, trenches, and specially designed pools or manholes. They are installed on or near the inlet or outlet to a closed pipe system to prevent erosion at these locations.

See SWMMWW Appendix V-A, Table V-A.7 for energy dissipater maintenance standards.

Discharge Point

Stormwater facility discharge points may convey drainage from the stormwater facility into open channels, ditches, ponds, wetlands, streams, or lakes. Stormwater facility discharge points need to be assessed to make sure stormwater is not causing any negative impacts to these drainage areas.

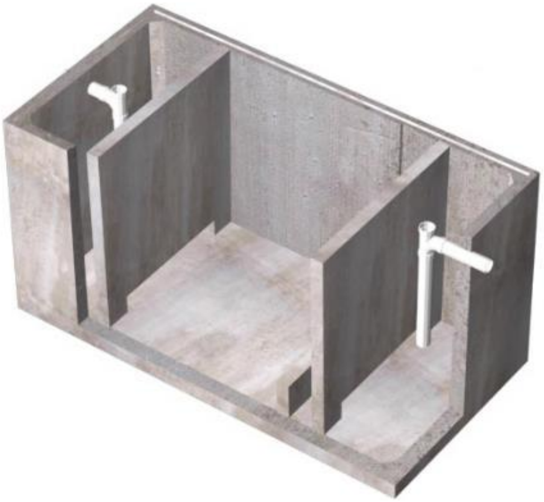
Discharge Point			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
Monitoring	Contaminants and Pollution	Any evidence of oil, gasoline, sewage, contaminants, or other pollutants	Identify and remove source. The effluent discharge should be clear and free of odor. Notify City at (360) 817-1567.
	Ditch or Stream Banks Eroding	Erosion, scouring, or head cuts in ditch or stream banks downstream of facility discharge point due to flow channelization or higher flows.	Stabilize ditch or stream banks. Report to City for engineer evaluation.
General	Missing or Moved Rock	Only one layer of rock exists above native soil in an area five square feet or larger, or any exposure of native soil	Replace or repair rock pad to design standards
	Erosion	Soil erosion in or adjacent to rock pad	Replace or repair rock pad to design standards
	Sediment	Sediment blocking 20% of the pipe diameter	Remove sediment
	Obstructions	Roots or debris enters pipe or deforms pipe, reducing flow	Remove roots from pipe by mechanical methods; do not use root-dissolving chemicals in storm sewer pipes. If necessary, remove vegetation over the line.
	Pipe Rusted or Deteriorated	Any part of the piping that is crushed or deformed excessively or any other failure to the piping	Repair or replace pipe
Energy Dissipater	See Energy Dissipater		

Oil/Water Separators

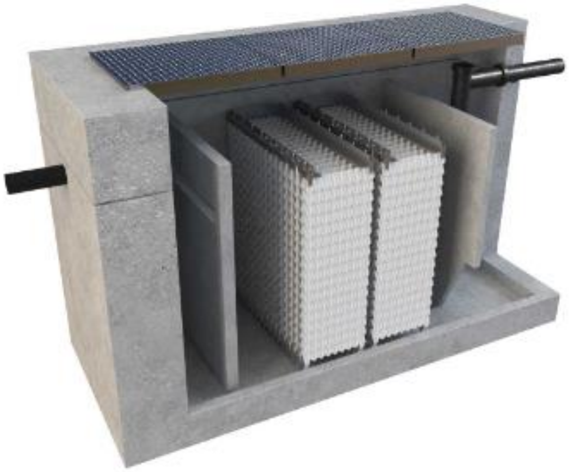
An oil/water separator is an underground vault that treats stormwater by mechanically separating oil from water. The oil rises to the surface and floats on the water and sediment settles to the bottom. Oil/water separators are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (e.g., service and fuel stations). Oil/water separators are most commonly used as the first pretreatment facility in a series of stormwater management facilities.

These facilities have special problems for maintenance and should be serviced by contractors. The main issues are working in confined spaces and properly handling any sludge and oil cleaned from vaults or oil/water separators. Manufacturer's recommendations for maintenance should be followed at a minimum.

See SWMMWW Appendix V-A, Table V-A.16 for baffle oil/water separator maintenance standards and Table V-A.17 for coalescing plate oil/water separator maintenance standards.



Baffle Oil/Water Separator

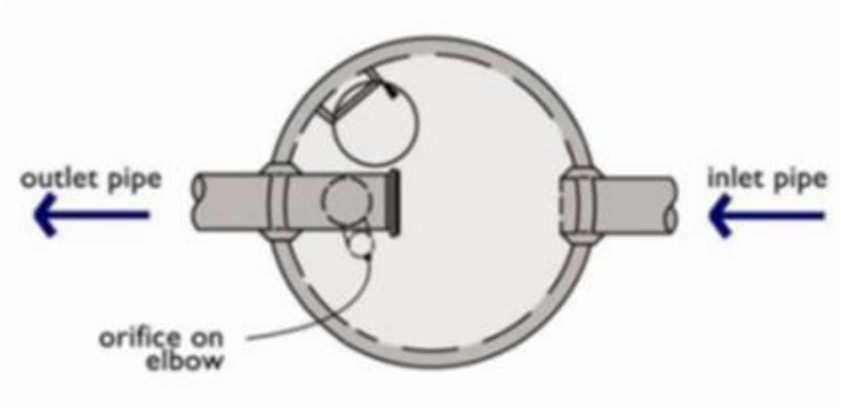


Coalescing Plate Oil/Water Separator

Flow Control Structures/Flow Restrictors

Flow control structures and flow restrictors direct or restrict flow in or out of facility components. Outflow controls on detention facilities are a common example where flow control structures slowly release stormwater at a specific rate. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or ‘V’ shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. If these flow controls are damaged, plugged, bypassed, or not working properly, the facility could overtop or release water too quickly.

See SWMMWW Appendix V-A, Table V-A.4 for control structure/flow restrictor maintenance standards.



Plan View

Storm Sewer Pipe

Storm sewer pipes convey stormwater. Storm pipes are constructed of many different types of materials and are sometimes perforated to allow groundwater to be collected by the storm system. Storm pipes are cleaned to remove sediment or blockages when problems are identified. Storm pipes must be clear of obstructions and breaks to prevent localized flooding.

Storm Sewer Pipe			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Obstructions, Including Roots	Obstruction exists in pipe, reducing flow capacity	Remove obstruction. Use mechanical methods. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the line.
	Pipe Dented or Broken	Inlet/outlet pipe damaged or broken	Repair or replace pipe
	Pipe rusted or deteriorated	Any part of the piping that is crushed or deformed excessively or any other failure to the piping	Repair or replace pipe
	Sediment and Debris	Sediment or debris depth is greater than 15% of the pipe diameter	Clean pipe. Evaluate source of sediment upstream of the pipe and stabilize if possible.
	Broken Trash Screen	Trash screen is broken or missing parts	Repair or replace trash screen
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.

Closed Detention System

A closed detention system functions similarly to a detention pond but with the storage volume provided by an underground structure. The structure is typically constructed of large diameter pipe, plastic chamber structure or a concrete vault. These systems are typically utilized for sites that do not have space available for an above-ground system and are more commonly associated with commercial sites.

Underground detention systems are enclosed spaces where harmful chemicals and vapors can accumulate. Therefore, the maintenance of these facilities should be conducted by an individual trained and certified to work in hazardous confined spaces.

See SWMMWW Appendix V-A, Table V-A.3 for closed detention maintenance standards.

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Drywell

Drywells are perforated, open-bottomed manholes used to infiltrate stormwater into the ground. While not the intended use, drywells trap sediment and some of the oil pollutants in stormwater runoff. Drywells are more likely to fill with oily sediment in areas that lack swales or other treatment facilities. Fine oil sediment can clog drywells and lead to localized street flooding. Also, pollutants discharged into drywells can migrate into groundwater. Drywells were often installed in closed topographic depressions, areas with will-drained soils, or areas having inadequate storm sewers. Often, drywells contain groundwater.

Drywell			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Does not Dissipate Stormwater	Does not dissipate stormwater	Replace or repair
	Opening Clogged	Openings are clogged, reducing capacity	Clear openings or convert existing drywell to a sediment trap and install a new drywell or drainage trench. To convert to a sediment trap: grout holes, cover base with concrete, and add piping. Alterations to any storm facility cannot be done without approval from the City of Camas.
	Standing Water	Standing water indicates the drywell is into the groundwater table	Rebuild drywell to prevent stormwater from going directly into groundwater
	Trash and Debris	Trash or debris blocking any inlet or outlet pipe	Remove trash and debris
	Sediment	Sediment in drywell exceeds 60 percent of the depth below the lowest pipe	Remove sediment
	Structure Damage	Structure unsound	Replace or repair drywell to design standards.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.
Cover	Cover Not in Place	Cover is missing or only partially in place.	Replace missing cover
	Cover Difficult to Remove	One maintenance person cannot remove cover after applying normal lifting pressure.	Make adjustments so that one maintenance person can remove the drywell cover.

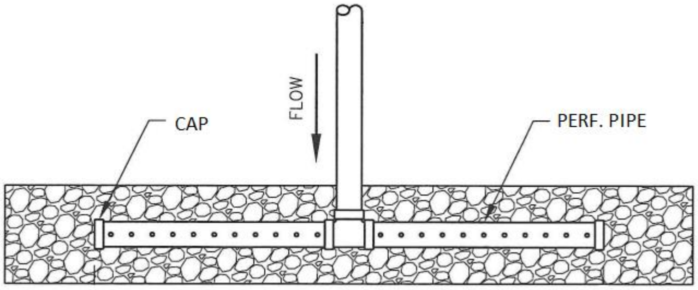
Pond Leveler System

The pond leveler system consists of an intake cage and outlet pipe. This system is used to bypass beaver dams. The pond leveler system creates a permanent leak through the beaver dam that the beavers cannot stop.

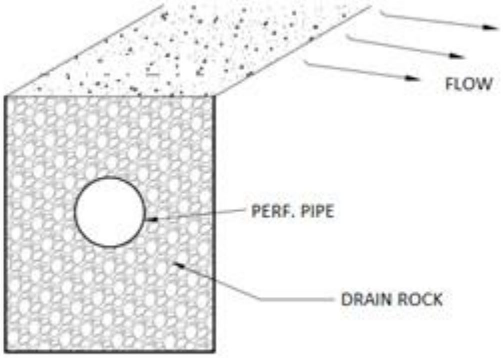
Pond Leveler			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
Intake Cage	Debris and sediment	Debris and sediment build up around cage	Remove debris and sediment build up around cage. Recommended tools: potato rake and a narrow, stiff shop broom.
	Structure	Broken cage, resulting in holes larger than 6" diameter.	Repair hole with similar cage material, attach with hog rings.
	Obstruction to inflow pipe	Debris obstructing pipe flow inside intake cage	Remove obstruction
Outflow Pipe	Obstruction	Debris obstructing outflow	Remove obstruction

Dispersion Trench

Dispersion trench are grave-filled trenches, which serve to spread runoff over vegetated pervious areas. This BMP reduce peak flows, provide some infiltration, and water quality benefits.



Plan View



Cross Section

Dispersion Trench			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Trash and Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Remove trash and debris from site.
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	Remove noxious weeds. Compliance with State or local eradication policies required. Apply requirements of adopted IPM policies for the use of herbicides.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Identify and remove source. Notify City at (360) 817-1567.
	Rodent Holes	Any evidence of rodent holes.	Fill holes.
Perforated Pipe	Sediment and/or obstruction	Sediment and/or obstruction impeding the flow, causing backup	Remove sediment and/or obstruction

Special Facilities

Manufactured Media Filter

Manufacture media filters are passive, flow-through, stormwater treatment systems. They are comprised of manholes or vaults that house media-filled filter cartridges. Stormwater passes through a filtering medium, which traps particulates and/or absorb pollutants such as dissolved metals and hydrocarbons. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharge to a pond or open channel drainage way.

The filter media can be housed in cartridge filters enclosed in concrete vaults or catch basins. Structures will have vault doors or manhole lids for maintenance access. Various types of filter media are available from different manufactures. Determine the type of filter media used and consult manufacturer for maintenance recommendations.

See SWMMWW Appendix V-A, Table V-A.15 for manufactured media filters maintenance standards.

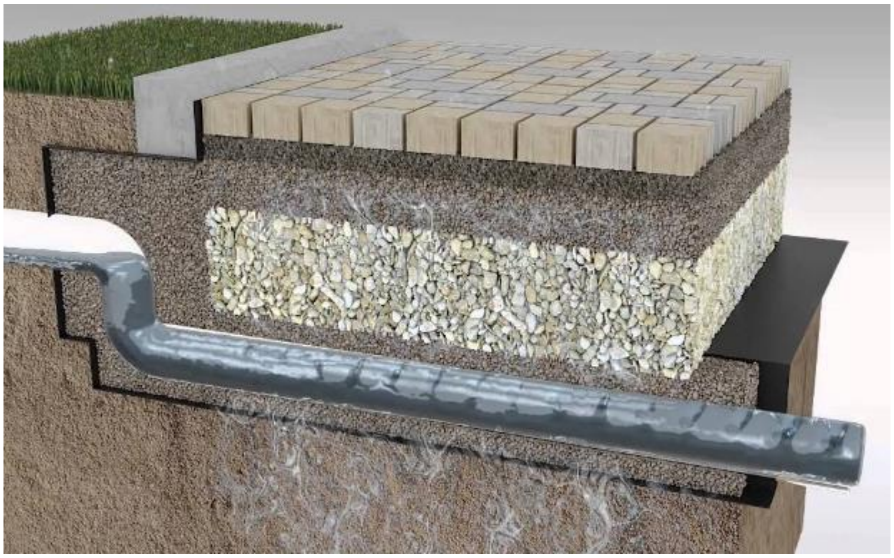
Manufactured Media Filter – Additional Maintenance Standards

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
Below Ground Vault or Manhole	Sediment Accumulation in Vault (no first chamber)	Sediment depth exceeds 4-inches on vault floor.	Remove sediment from vault floor. May require replacing media cartridges, consult manufacturer.

Permeable Pavement

Permeable pavement is a paving system which allows rainfall to percolate through the surface into the underlying soil or an aggregate bed, where stormwater is stored and infiltrated to underlying subgrade, or removed by an overflow drainage system.

See SWMMWW Appendix V-A, Table V-A.22 for permeable pavement maintenance standards.



Modular Wetland

Modular wetlands linear is a biofiltration system that utilizes horizontal flow which allows for a smaller footprint, higher treatment capacity and design versatility. This system can be utilized downstream of storage for additional volume control and treatment. The modular wetland is contained in an underground vault that has different chambers containing media. Some modular wetlands can have plants growing out of it, but it is not required for the system to function. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharge to a pond or open channel drainage way.

Modular Wetland			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
General	Missing or damaged components	Missing or damaged internal components or cartridges	Replace missing or repair damaged internal components or cartridges
Inlet or Outlet	Obstruction	Obstruction to inlet or outlet that impedes flow	Remove obstruction
Pretreatment Chamber	Floatables	Excessive accumulation of floatables, in which the length and width of the chamber is fully impacted more than 18"	Remove floatables
	Sediment	Excessive accumulation of sediment, more than 6"in depth	Remove sediment
Filter Cartridges	Sediment	Excessive accumulation of sediment on media, more than 85% clogged (blackish color)	Replace media
Vegetation (if applicable)	Overgrown	Overgrown vegetation	Trim/prune vegetation in accordance with landscaping and safety needs
Structure	Cracks in structure	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through cracks	Repair cracks in vault

Tree Box Filter

Tree box filter is a stormwater treatment system incorporating high performance biofiltration media to remove pollutants from stormwater runoff.

Tree Box Filter			
Maintenance Component	**Defect or Problem**	**Conditions When Maintenance Is Needed**	**Minimum Maintenance Required**
Inlet	Excessive sediment or trash accumulation	Accumulated sediments or trash impair free flow of water into system	Remove sediment and/or trash
Mulch cover	Trash and debris	Excessive trash and/or debris accumulation	Remove trash and/or debris.
	Standing water	Ponding of water over mulch due to excessive fine sediment accumulation or spill of petroleum oils	Remove mulch and replace, contact manufacturer for advice
Vegetation	Plant not growing or in poor condition	Soil/mulch too wet, evidence of spill, incorrect plant selection, pest infestation, vandalism to plants	Plants should be healthy and pest free, contact manufacturer for advice
	Plant growth excessive	Plants should be appropriate to the species and location	Trim/prune plants in accordance with landscaping and safety needs
Structure	Cracks in structure	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through cracks	Repair cracks in vault

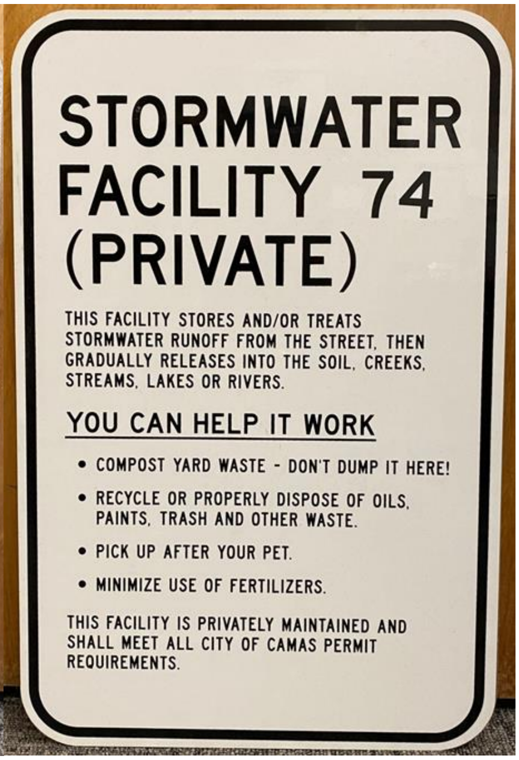
Miscellaneous Items

Fences, Gates and Water Quality Signs

Fences are installed around the perimeter of stormwater facilities as a means of protecting the public, as they restrict entrance to the facility. Gates are installed to allow for maintenance access. Gates will be secured, typically with a double lock system (daisy chain) that allows access to the City and to the property owner's maintenance crew.

Water Quality Signs are installed on the fences, or on sign poles, within public view as a means of educating the public as to the presence of a stormwater facility. These signs also have a number located in the upper right hand corner that is cross referenced, at the City, to an address and maintenance responsibility. The publicly owned storm facility signs are green and the privately owned storm facility signs are white.

Public Storm Sign (Green)



Private Storm Sign (White)

Fence, Gate and Water Quality Sign

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Gate or Fence Allows Unauthorized Entry	Openings in fence, missing gate, openings beneath fence allowing unauthorized access	Repaired gate and/or fence to prevent unauthorized access
	Locking Mechanism	Mechanism cannot be opened by one maintenance person with proper tools	Repair/replace lock
		No lock on gate, allows unauthorized entry	Add lock
	Damaged Parts	Posts out of plumb more than six inches	Plumb post
		Top rails of plump more than six inches	Repair top rails so that it is free of bends greater than 1 inch
	Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets	Replace soil under fence so that no opening exceeds 4 inches in height
	Sign	Sign is leaning more than 8 inches off vertical	Reset sign to plumb
		Sign is missing or 20% of surface is unreadable	Replace sign

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Access Roads and Easements

Many stormwater facilities have access roads to bring in heavy equipment for facility maintenance. These roads are typically gravel and should be maintained for inspection access and ease of equipment entry. All facilities should allow access for the inspection process. The easement area should be adequately or otherwise stabilized. Bare soil areas will generate higher levels of stormwater runoff and increase erosion and sedimentation in stormwater facilities.

Access Road and Easements

Maintenance Component	Defect or Problem	Conditions When Maintenance Is Needed	Minimum Maintenance Required
General	Erosion	Soils are bare or eroded	Seed or use other stabilization BMP
	Road Surface	Conditions of road surface may lead to erosion of the facility or limit access	Repair road
	Erosion of Ground Surface	Noticeable rills are seen in landscaped areas	Identify causes of erosion and implement BMPs to slow down/spread out the water. Fill, contour, and seed eroded areas. If needed, re-grade affected areas.
	Trash and Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Remove trash and debris from site.
	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	Remove noxious weeds. Compliance with State or local eradication policies required. Apply requirements of adopted IPM policies for the use of herbicides.
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If dead, diseased, or dying trees are identified.	Remove hazardous tree that impede with maintenance access and activities. Remove trees that are damaging the pipe system and/or blocking drain inlet. Remove dead, diseased, or dying trees. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).
	Weeds (Non-poisonous)	Weeds growing in more than 20% of the landscaped area (tree and shrubs only).	Remove weeds
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Destroy or remove insects from site. Apply insecticides in compliance with adopted IPM policies.

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Pavement Sweeping

Pavement sweeping is performed as a means of removing sand, dirt, and litter from streets and curb gutters. Sweeping also reduces dust during dry weather. Pavement sweeping plays a large part in stormwater maintenance because it limits the amount of sediment washed into the municipal storm sewer system. The water quality procedure for street sweeping focuses on sediment removal and disposal. Reducing the amount of sediment washed into catch basins, curb inlets, detention facilities, drywells, and other facilities can save money because sweeping is generally cheaper that removing sediment from facilities. Sweeping also helps protect facilities from clogging with sediment.

Typically, the City sweeps the downtown area once a week and the whole city about three times per year. Most of the downtown area does not have water quality treatment. Pavement sweeping is the main source for pollution control.

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Repair/Replacement Activities

Minor Culvert Repair (Not in a Stream)

This activity is for the replacement or repair of culverts and inlets. It applies only to structures that are in ditches that are specifically for storm drainage. These are ditches that do not carry water during dry weather. If there is any question about whether the ditch is a storm drain or a stream, consult with the Washington Department of Fish and Wildlife and the City of Camas Public Works Department.

Major Culvert Repair (at a Stream Crossing)

This activity is the replacement or repair of culverts and inlets bridging a stream or ditch with flowing water during dry weather. If there is any question about whether the ditch is a storm drain or a stream, consult the Washington Department of Fish and Wildlife and the City of Camas Public Works Department.

These projects must meet all regulatory requirements such as State Environmental Policy Act (SEPA), Shoreline Permit, Hydraulic Project Approval (HPA) and Flood Plain.

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Vegetation Management

The City recognizes the special importance of the rivers, streams, wetlands, ponds, and stormwater control and treatment facilities. The sensitive nature of such habitat, their plant and animal communities, and their direct link with other waterways require that we establish specific policies to ensure their health. All landscape management decisions for controlling unwanted vegetation, diseases, and pests should follow the Integrated Pest Management (IPM) principles and decision-making rationale.

Integrated Pest Management (IPM) Principles

1. Correctly identify the pest problem and understand their life cycle. Refer to online resources such as Washington State Noxious Weed Control Board and Washington Invasive Species Council.
2. Every landscape has a population of some pest insects, weeds, and diseases. Once the pest has been identified and studied, determine if low levels of the pest are tolerable. Small numbers of certain pests may not be harmful. If this is the case, simply continue to monitor the pest population.
3. If pest exceed tolerance thresholds, choose a safe and effective control method.
    a. Cultural methods of vegetation and pest control are preferred and are first employed. Cultural control changes the pest’s environment: landscape fabric, mulch, soil amendments, altering the irrigation method of duration, crop rotation, crop covers, etc.
    b. Mechanical means of vegetation and pest control are next in line of preference and are utilized where feasible. Mechanical means consist of digging, hand-pulling, mowing, tilling, trapping, etc.
    c. Biological methods of vegetation and pest control are considered before chemical means, where they are feasible. Biological control uses natural enemies: beneficial insects, managed grazing, bird boxes and perches, etc.
    d. Chemical methods are used only when no other feasible methods exist. Chemical control is the use of pesticides to remove vegetation and pests.
4. Observe and record the results of the control treatment. Evaluate the effectiveness. If necessary, modify maintenance practices to support a healthy landscape and prevent recurrence of the pest.

A licensed pesticide applicator is required for performing any chemical application in stormwater facilities. Applicators must be licensed in Washington State with an aquatic endorsement (WAC 16-228-1545). Applicator must submit a copy of their license to the City prior to starting work. Aquatic pesticide products are recommended. No chemical application shall be applied directly in the water. Do not apply pesticide when it is raining. Check the weather and ensure there are multiple dry days before and after application. Do not apply pesticide on windy days to prevent drift movement of pesticide from target areas.

For vegetated areas outside of stormwater facilities, Washington State pesticide application laws and rules are followed, Chapter 17.21 RCW and Chapter 16-228 WAC.

Plants and Groundcover

Use plants that will thrive in the growing conditions of each facility. Growing conditions are affected by moisture, soil conditions, and light. Plants native to western Washington are preferred. Recommended plants, seed mixes and groundcover list for biofiltration swales, bioretention systems, rain gardens, and other facility types are given in the respective BMP maintenance sections. It is best to reference the stormwater facility record drawings for vegetation replacements, if available. Fertilization of vegetated stormwater facilities should be avoided.

The City has adopted a list of approved plants for use in development projects, and to assist homeowners in choosing appropriate plantings. The list also has prohibited undesirable plants. Only plants approved for use on the City of Camas Plant Materials are allowed within the City's right-of-way.

Mulches and other ground coverings are useful during the installation and restoration of landscapes as well as their ongoing maintenance. Mulches meet a variety of needs. They suppress weeds, help to retain moisture around plants, reduce possible erosion and provide visual enhancement. Possible risk impacts to consider when using mulch are inadvertent introduction of non-native plants or migration of mulch material into waterways.

Possible scenarios where trees should be removed and/or trimmed in a stormwater facility (always check if the stormwater facility has a liner before tree removal):

- Trees that pose a risk to a stormwater structure due to root growth should be removed.
- Trees that are growing on spillways that would impede drainage should be removed.
- Hazardous trees should be removed.
- Trees/shrubs that hinder accessibility to access roads should be trimmed or removed.

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APPENDIX E

Stormwater Pollution Prevention Plan

Exhibit 21 SUB25-1004

Stormwater Pollution Prevention Plan

For
Reserve at Green Mountain

Prepared For
Pacific Lifestyle Home
11815 NE 99th Street
Vancouver, WA 98682

Owner	Developer	Operator/Contractor
Marwan Bahu	Pacific Lifestyle Home	Unknown
PO Box 744	11815 NE 99th Street	
San Clemente, CA 92672	Vancouver, WA 98682	

Project Site Location
2625 NE 28th Street
Camas, WA 98607
Parcel #173192000

SWPPP Prepared By
PLS Engineering, Inc.
604 W Evergreen Blvd
Vancouver, WA 98660
(360) 944-6519

SWPPP Preparation Date
May 2025

Approximate Project Construction Dates
TBD

Contents

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Appendix A Site plans

- Vicinity map (with all discharge points)
- Site plan with TESC measures

Appendix B Construction BMPs

- Possibly reference in BMPs, but likely it will be a consolidated list so that the applicant can photocopy from the list from the SWMMWW.

Appendix C Alternative Construction BMP list

- List of BMPs not selected, but can be referenced if needed in each of the 12 elements

Appendix D General Permit

Appendix E Site Log and Inspection Forms

Appendix F Engineering Calculations

Exhibit 21 SUB25-1004

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1.0 Introduction

This Stormwater Pollution Prevention Plan (SWPPP) has been prepared for the Reserve at Green Mountain construction project in Camas, Washington. The site is located on Parcel 173192000. Current address for the site is 2625 NE Goodwin Rd, Camas, WA 98607 and the existing site is approximately 11.67 acres. Current proposed development associated with this SWPPP includes the construction of 37 single family lots and one existing house, along with the associated infrastructure. The stormwater plan associated with this project provides for stormwater management of all runoff from the site using a stormwater detention facility. Stormwater runoff from the pollution generating surfaces will be treated by a ConTech media cartridge before being stored and released.

Construction activities will include excavation, grading, construction of paving and sidewalk to serve the site, construction of a detention pond to mitigate for impacts to stormwater runoff from the new paving, and installation of utilities to serve the site including sanitary sewer, storm sewer, potable water, electrical, phone, and cable TV. The purpose of this SWPPP is to describe the proposed construction activities and all temporary and permanent erosion and sediment control (TESC) measures, pollution prevention measures, inspection/monitoring activities, and recordkeeping that will be implemented during the proposed construction project. The objectives of the SWPPP are to:

1. Implement Best Management Practices (BMPs) to prevent erosion and sedimentation, and to identify, reduce, eliminate or prevent stormwater contamination and water pollution from construction activity.

2. Prevent violations of surface water quality, ground water quality, or sediment management standards.

3. Prevent, during the construction phase, adverse water quality impacts including impacts on beneficial uses of the receiving water by controlling peak flow rates and volumes of stormwater runoff at the Permittee's outfalls and downstream of the outfalls.

This SWPPP was prepared using the Ecology SWPPP Template downloaded from the Ecology website. This SWPPP was prepared based on the requirements set forth in the Construction Stormwater General Permit and the *Stormwater Management Manual for Western Washington* (SWMMWW). The report is divided into seven main sections with several appendices that include stormwater related reference materials. The topics presented in the each of the main sections are:

- Section 1 – INTRODUCTION. This section provides a summary description of the project, and the organization of the SWPPP document.

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- Section 2 – SITE DESCRIPTION. This section provides a detailed description of the existing site conditions, proposed construction activities, and calculated stormwater flow rates for existing conditions and post–construction conditions.

- Section 3 – CONSTRUCTION BMPs. This section provides a detailed description of the BMPs to be implemented based on the 12 required elements of the SWPPP (SWMMEW 2004).

- Section 4 – CONSTRUCTION PHASING AND BMP IMPLEMENTATION. This section provides a description of the timing of the BMP implementation in relation to the project schedule.

- Section 5 – POLLUTION PREVENTION TEAM. This section identifies the appropriate contact names (emergency and non-emergency), monitoring personnel, and the onsite temporary erosion and sedimentation control inspector

- Section 6 – INSPECTION AND MONITORING. This section provides a description of the inspection and monitoring requirements such as the parameters of concern to be monitored, sample locations, sample frequencies, and sampling methods for all stormwater discharge locations from the site.

- Section 7 – RECORDKEEPING. This section describes the requirements for documentation of the BMP implementation, site inspections, monitoring results, and changes to the implementation of certain BMPs due to site factors experienced during construction.

Supporting documentation and standard forms are provided in the following Appendices:

Appendix A – Site plans
Appendix B – Construction BMPs
Appendix C – Alternative Construction BMP list
Appendix D – General Permit
Appendix E – Site Log and Inspection Forms
Appendix F – Engineering Calculations

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2.0 Site Description

2.1 Existing Conditions

Current Addresses for the site is 2625 NE Goodwin Rd, Camas, WA 98607. The site is approximately 11.67 acres. The property's topography is moderately sloped from a high point at the NE corner of the site to a low point at the SW corner of the site. The site has an existing house which will remain, and a garage and concrete building foundation which will be removed. The remaining area consists of grass, trees, and brush.

The soils are mapped by the NRCS as McBee silt loam (MlA) in the Northeast corner of the site, Dollar loam (DoB), in the north, Cove silty clay (CvA) on the West edge and Southwest section, and Lauren gravelly loam (LrC) in under the existing house and Southwest corner.

2.2 Proposed Construction Activities

The project proposes to develop the parcel into 38 single family lots and associated access. Construction activities will include excavation, grading, construction of paving and sidewalk to serve the site, construction of an detention pond to mitigate for impacts to stormwater runoff from the new paving, and installation of utilities to serve the site including sanitary sewer, storm sewer, potable water, electrical, phone, and cable TV.

Temporary erosion and sediment control facilities will be installed prior to site construction to handle construction-phase stormwater runoff. The schedule and phasing of BMPs during construction is provided in Section 4.0.

Stormwater runoff has been calculated using Western Washington Hydrology Model (WWHM). The detention pond was designed to store and release the runoff generated by the site. ConTech^{TM} catch basins will be used to treat runoff before conveying it to the detention pond.

After the site has been graded and all new utilities are installed, the building construction will commence. Trees will also be planted in the landscape areas noted in the Landscape Plan. Temporary seeding will occur over the lots to establish vegetative cover until such time as individual buildings are developed and permanent landscaping occurs.

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3.0 Construction Stormwater BMPs

3.1 The 13 BMP Elements

3.1.1 Element #1 – Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible. The BMPs relevant to marking the clearing limits that will be applied for this project include:

- Preserving Native Vegetation (BMP C101)
- Silt Fence (BMP C233)

Alternate BMPs for marking clearing limits are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

3.1.2 Element #2 – Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, and wheel washing, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters. All wash wastewater shall be controlled on site. The specific BMPs related to establishing construction access that will be used on this project include:

- Stabilized Construction Entrance (BMP C105)

Alternate construction access BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

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3.1.3 Element #3 – Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. The specific BMP for flow control that shall be used on this project include:

- Detention Ponds (BMP D.1)

Alternate flow control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, the project must comply with Minimum Requirement 7 (Ecology 2005).

In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements (e.g. discharge to combined sewer systems).

3.1.4 Element #4 – Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to an infiltration facility. The specific BMPs to be used for controlling sediment on this project include:

- Silt Fence (BMP C233)
- Storm Drain Inlet Protection (BMP C220)

Silt fencing and storm drain inlet protection will be adequate for sediment control during summer months. Alternate sediment control BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize washoff of sediments from adjacent streets in runoff.

Whenever possible, sediment laden water shall be discharged into onsite, relatively level, vegetated areas (BMP C240 paragraph 5, page 4-102).

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In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or biofiltration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be restabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

The following BMPs will be implemented as end-of-pipe sediment controls as required to meet permitted turbidity limits in the site discharge(s). Prior to the implementation of these technologies, sediment sources and erosion control and soil stabilization BMP efforts will be maximized to reduce the need for end-of-pipe sedimentation controls.

- Construction Stormwater Filtration (BMP C251)
- Construction Stormwater Chemical Treatment (BMP C 250) (implemented only with prior written approval from Ecology).

3.1.5 Element #5 – Stabilize Soils

Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Nets and Blankets (BMP C122)
- Plastic Covering (BMP C123)
- Topsoiling (BMP C125)
- Surface Roughening (BMP C130)
- Dust Control (BMP C140)
- Early application of gravel base on areas to be paved

Alternate soil stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils

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shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

3.1.6 Element #6 – Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion. The following specific BMPs will be used to protect slopes for this project:

- Temporary and Permanent Seeding (BMP C120)

Alternate slope protection BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

3.1.7 Element #7 – Protect Drain Inlets

All storm drain inlets and culverts made operable during construction or inlets near the site that could potentially receive surface runoff from the construction site shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site. The following inlet protection measures will be applied on this project:

Drop Inlet Protection

- Block and Gravel Drop Inlet Protection
- Gravel and Wire Drop Inlet Protection
- Catch Basin Filter

If the BMP options listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D), or if no BMPs are listed above but deemed necessary during construction, the Certified Erosion and Sediment Control Lead shall implement one or more of the alternative BMP inlet protection options listed in Appendix C.

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3.1.8 Element #8 – Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion. The specific BMPs for channel and outlet stabilization that shall be used on this project include:

- Outlet Protection (BMP C209)

Alternate channel and outlet stabilization BMPs are included in Appendix C as a quick reference tool for the onsite inspector in the event the BMP(s) listed above are deemed ineffective or inappropriate during construction to satisfy the requirements set forth in the General NPDES Permit (Appendix D). To avoid potential erosion and sediment control issues that may cause a violation(s) of the NPDES Construction Stormwater permit (as provided in Appendix D), the Certified Erosion and Sediment Control Lead will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix C after the first sign that existing BMPs are ineffective or failing.

The project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. Alternatively, the 10-year, 1-hour peak flow rate indicated by an approved continuous runoff simulation model, increased by a factor of 1.6, shall be used. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent streambanks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.

3.1.9 Element #9 – Control Pollutants

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMPC153 for Material Delivery, Storage and Containment in SWMMWW 2005
- Application of agricultural chemicals, including fertilizers and pesticides, shall be conducted in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Manufacturers' recommendations for application procedures and rates shall be followed.

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).
- Process water and slurry resulting from sawcutting and surfacing operations will be prevented from entering the waters of the State by implementing Sawcutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

Sanitary wastewater:

- Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.
- Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system or to the sanitary sewer as part of Wheel Wash implementation (BMP C106).

Solid Waste:

- Solid waste will be stored in secure, clearly marked containers.

Other:

- Other BMPs will be administered as necessary to address any additional pollutant sources on site.

The facility does not require a Spill Prevention, Control, and Countermeasure (SPCC) Plan under the Federal regulations of the Clean Water Act (CWA).

3.1.10 Element #10 – Control Dewatering

3.1.13 Element #13 – Protect Low Impact Development BMPs

- Protect all bioretention and rain garden BMP’s from sedimentation through installation and maintenance of erosion control BMP’s on portions of the site that drain into them. Restore the BMP’s to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden bioretention/ rain garden soils, and replacing the removed soils with soils meeting the design specification.
- Prevent compacting bioretention and rain garden BMP’s by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction by construction equipment.
- Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff into permeable pavements or base materials.
- Pavements fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures from Book 4 of the manufacturer’s procedures.
- Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils

3.2 Site Specific BMPs

Site specific BMPs are shown on the TESC Plan Sheets and Details in Appendix A. These site-specific plan sheets will be updated annually.

3.3 Additional Advanced BMPs

- The following BMPs are advanced and are only recommended if construction activities are complex enough to warrant them; or if the site has the potential for significant impacts to water quality. The following BMPs are directed at “end-of-pipe” treatment for sedimentation issues related to turbid runoff from construction sites. Effective BMPs are most often the simple BMPs and focus on the minimization of erosion before sedimentation is an issue. The following BMPs will most likely be implemented only after other BMP options are exhausted, or if the construction activity is large and off-site sedimentation or turbid runoff occurs or is inevitable.
- For BMP 250, written pre-approval, through Ecology is required (see SWMMWW 2005):
- BMP C250: Construction Stormwater Chemical Treatment
- BMP C251: Construction Stormwater Filtration.

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4.0 Construction Phasing and BMP Implementation

The BMP implementation schedule will be driven by the construction schedule. The following provides a sequential list of the proposed construction schedule milestones and the corresponding BMP implementation schedule. The list contains key milestones such as wet season construction.

The BMP implementation schedule listed below is keyed to proposed phases of the construction project and reflects differences in BMP installations and inspections that relate to wet season construction. The project site is located west of the Cascade Mountain Crest. As such, the dry season is considered to be from May 1 to September 30 and the wet season is considered to be from October 1 to April 30.

- Estimate of Construction start date: TBD
- Estimate of Construction finish date: TBD
- Mobilize equipment on site: TBD
- Mobilize and store all ESC and soil stabilization products: TBD
- Install ESC measures: TBD
- Install stabilized construction entrance: TBD
- Begin clearing and grubbing: TBD
- Demolish existing structures: TBD
- Begin site grading TBD
- Site grading ends TBD
- Excavate and install new utilities and services: TBD

  Excavation for building foundations TBD
- Begin building construction: TBD

  Complete utility construction TBD
- Begin implementing soil stabilization and sediment control BMPs throughout the site in preparation for wet season: TBD
- Wet Season starts: 11/01/25
- Site inspections and monitoring conducted weekly and for applicable rain events as detailed in Section 6 of this SWPPP: TBD
- Implement Element #12 BMPs and manage site to minimize soil disturbance during the wet season: TBD
- Complete road paving TBD
- Building construction complete: TBD
- Dry Season starts: 5/01/26

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5.0 Pollution Prevention Team

5.1 Roles and Responsibilities

The pollution prevention team consists of personnel responsible for implementation of the SWPPP, including the following:

- Certified Erosion and Sediment Control Lead (CESCL) – primary contractor contact, responsible for site inspections (BMPs, visual monitoring, sampling, etc.); to be called upon in case of failure of any ESC measures.
- Resident Engineer – For projects with engineered structures only (sediment ponds/traps, sand filters, etc.): site representative for the owner that is the project's supervising engineer responsible for inspections and issuing instructions and drawings to the contractor's site supervisor or representative
- Emergency Ecology Contact – individual to be contacted at Ecology in case of emergency.
- Emergency Owner Contact – individual that is the site owner or representative of the site owner to be contacted in the case of an emergency.
- Non-Emergency Ecology Contact – individual that is the site owner or representative of the site owner than can be contacted if required.
- Monitoring Personnel – personnel responsible for conducting water quality monitoring; for most sites this person is also the Certified Erosion and Sediment Control Lead.

5.2 Team Members

Names and contact information for those identified as members of the pollution prevention team are provided in the following table.

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	Unknown	
Resident Engineer	Travis Johnson	(360)944-6519
Emergency Ecology Contact	Unknown	
Emergency Owner Contact	Unknown	
Non-Emergency Ecology Contact	Unknown	
Monitoring Personnel	Unknown	

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6.0 Site Inspections and Monitoring

Monitoring includes visual inspection, monitoring for water quality parameters of concern, and documentation of the inspection and monitoring findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements;
- Site inspections; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book. This SWPPP may function as the site log book if desired, or the forms may be separated and included in a separate site log book. However, if separated, the site log book but must be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

6.1 Site Inspection

All BMPs will be inspected, maintained, and repaired as needed to assure continued performance of their intended function. The inspector will be a Certified Erosion and Sediment Control Lead (CESCL) per BMP C160. The name and contact information for the CESCL is provided in Section 5 of this SWPPP.

Site inspection will occur in all areas disturbed by construction activities and at all stormwater discharge points. Stormwater will be examined for the presence of suspended sediment, turbidity, discoloration, and oily sheen. The site inspector will evaluate and document the effectiveness of the installed BMPs and determine if it is necessary to repair or replace any of the BMPs to improve the quality of stormwater discharges. All maintenance and repairs will be documented in the site log book or forms provided in this document. All new BMPs or design changes will be documented in the SWPPP as soon as possible.

6.1.1 Site Inspection Frequency

Site inspections will be conducted at least once a week and within 24 hours following any discharge from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month.

6.1.2 Site Inspection Documentation

The site inspector will record each site inspection using the site log inspection forms provided in Appendix E. The site inspection log forms may be separated from this SWPPP document, but will be maintained on-site or within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

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6.2 Stormwater Quality Monitoring

The construction site will comply with the requirements set forth in the 2015 Construction Stormwater General Permit (revised 2017) seen in Appendix D. A Certified Erosion and Sediment Control Lead shall be on-site or on-call at all times.

The following text describes the monitoring for the proposed development.

6.2.1 Turbidity Sampling

The receiving water body, Lacamas Creek Watershed, is impaired for turbidity. Mandatory BMPs (Best Management Practices) and erosion control practices put in place by the permit will appropriately minimize the turbidity of the stormwater discharge. Monitoring requirements for the proposed project will include weekly turbidity sampling to monitor site discharges for water quality compliance as required by the NPDES Construction Stormwater General Permit, provided that site discharges occur. It should be noted that the site is designed such that all site runoff will be infiltrated so it is likely that discharges will be rare or may not occur at all. Sampling will be conducted at all discharge points at least once per calendar week.

Turbidity sampling during construction will be completed weekly in order to confirm that erosion control measures are meeting the water quality standards for turbidity (Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharge, but has not excluded these discharges, compliance with special Conditions S4 (monitoring) and S9 (SWPPPs) will constitute compliance with the approved TMDL (S8.E.1.c)). Special Conditions S4 establishes that the key benchmark values that require action are 25 NTU for turbidity (equivalent to 32 cm transparency) and 250 NTU for turbidity (equivalent to 6 cm transparency). If the 25 NTU benchmark for turbidity (equivalent to 32 cm transparency) is exceeded, the following steps will be conducted:

1. Ensure all BMPs specified in this SWPPP are installed and functioning as intended.
2. Assess whether additional BMPs should be implemented, and document revisions to the SWPPP as necessary.
3. Sample discharge location daily until the analysis results are less than 25 NTU (turbidity) or greater than 32 cm (transparency).

If the turbidity is greater than 25 NTU (or transparency is less than 32 cm) but less than 250 NTU (transparency greater than 6 cm) for more than 3 days, additional treatment BMPs will be implemented within 24 hours of the third consecutive sample that exceeded the benchmark value. Additional treatment BMPs to be considered will include, but are not limited to, off-site treatment, infiltration, filtration and chemical treatment.

If the 250 NTU benchmark for turbidity (or less than 6 cm transparency) is exceeded at any time, the following steps will be conducted:

1. Notify Ecology by phone within 24 hours of analysis (see Section 5.0 of this SWPPP for contact information).
2. Continue daily sampling until the turbidity is less than 25 NTU (or transparency is greater than 32 cm).

3. Initiate additional treatment BMPs such as off-site treatment, infiltration, filtration and chemical treatment within 24 hours of the first 250 NTU exceedance.
4. Implement additional treatment BMPs as soon as possible, but within 7 days of the first 250 NTU exceedance.
5. Describe inspection results and remedial actions taken in the site log book and in monthly discharge monitoring reports as described in Section 7.0 of this SWPPP.

In the event that Turbidity results are greater than 25 NTUs, or the site is determined to be out of compliance with surface water quality standards for turbidity, the following BMPs should be established, re-established or implemented as determined necessary by the Certified Erosion and Sediment Control lead (CESCL) in order to bring the site back into compliance:

BMP C105: Stabilized Construction Entrance / Exit (repair construction entrance as necessary)

BMP C106: Wheel Wash (repair wheel wash as necessary)

BMP C120: Temporary and permanent Seeding

BMP C124: Sodding

BMP C140: Dust Control

BMP C209: Outlet Protection

BMP C220: Storm Drain Inlet Protection (add more inlet protection, as necessary

BMP C233: Silt Fence (add more silt fencing as necessary)

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7.0 Reporting and Recordkeeping

7.1 Recordkeeping

7.1.1 Site Log Book

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements;
- Site inspections; and,
- Stormwater quality monitoring.

For convenience, the inspection form and water quality monitoring forms included in this SWPPP include the required information for the site log book.

7.1.2 Records Retention

Records of all monitoring information (site log book, inspection reports/checklists, etc.), this Stormwater Pollution Prevention Plan, and any other documentation of compliance with permit requirements will be retained during the life of the construction project and for a minimum of three years following the termination of permit coverage in accordance with permit condition S5.C.

7.1.3 Access to Plans and Records

The SWPPP, General Permit, Notice of Authorization letter, and Site Log Book will be retained on site or within reasonable access to the site and will be made immediately available upon request to Ecology or the local jurisdiction. A copy of this SWPPP will be provided to Ecology within 14 days of receipt of a written request for the SWPPP from Ecology. Any other information requested by Ecology will be submitted within a reasonable time. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with permit condition S5.G.

7.1.4 Updating the SWPPP

In accordance with Conditions S3, S4.B, and S9.B.3 of the General Permit, this SWPPP will be modified if the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site or there has been a change in design, construction, operation, or maintenance at the site that has a significant effect on the discharge, or potential for discharge, of pollutants to the waters of the State. The SWPPP will be modified within seven days of determination based on inspection(s) that additional or modified BMPs are necessary to correct problems identified, and an updated timeline for BMP implementation will be prepared.

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7.2 Reporting

7.2.1 Discharge Monitoring Reports

Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period, the Permittee shall submit the form as required, with the words “No discharge” entered in the place of monitoring results. The DMR due date is 15 days following the end of each month.

Water quality sampling results will be submitted to Ecology monthly on Discharge Monitoring Report (DMR) forms in accordance with permit condition S5.B. If there was no discharge during a given monitoring period, the form will be submitted with the words “no discharge” entered in place of the monitoring results. If a benchmark was exceeded, a brief summary of inspection results and remedial actions taken will be included. If sampling could not be performed during a monitoring period, a DMR will be submitted with an explanation of why sampling could not be performed.

7.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit are not met, and it causes a threat to human health or the environment, the following steps will be taken in accordance with permit section S5.F:

1. Ecology will be immediately notified of the failure to comply.
2. Immediate action will be taken to control the noncompliance issue and to correct the problem. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Any time turbidity sampling indicates turbidity is 250 nephelometric turbidity units (NTU) or greater or water transparency is 6 centimeters or less, the Ecology regional office will be notified by phone within 24 hours of analysis as required by permit condition S5.A (see Section 5.0 of this SWPPP for contact information).

In accordance with permit condition S2.A, a complete application form will be submitted to Ecology and the appropriate local jurisdiction (if applicable) to be covered by the General Permit.

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Appendix A – Site Plans

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Appendix B – Construction BMPs

Stabilized Construction Entrance (BMP C105)

Silt Fence (BMP C233)

Storm Drain Inlet Protection (BMP C220)

Detention Pond (BMP D.1)

Temporary and Permanent Seeding (BMP C120)

Mulching (BMP C121)

Nets and Blankets (BMP C122)

Plastic Covering (BMP C123)

Topsoiling (BMP C125)

Dust Control (BMP C140)

Early application of gravel base on areas to be paved

Outlet Protection (BMP C209)

Appendix C – Alternative BMPs

The following includes a list of possible alternative BMPs for each of the 12 elements not described in the main SWPPP text. This list can be referenced in the event a BMP for a specific element is not functioning as designed and an alternative BMP needs to be implemented.

Element #1 - Mark Clearing Limits
High Visibility Plastic or Metal Fence (BMP C103)
Stake and Wire Fence (BMP C104)
Element #2 - Establish Construction Access
Wheel Wash (BMP C106)
Water Bars (BMP C203)
Element #3 - Control Flow Rates
Wattles (BMP C235)

Element #4 - Install Sediment Controls
Straw Bale Barrier (BMP C230)
Gravel Filter Berm (BMP C232)
Straw Wattles (BMP C235)
Portable Water Storage Tanks (Baker Tanks)
Construction Stormwater Chemical Treatment (BMP C250)
Construction Stormwater Filtration (BMP C251)

Element #5 - Stabilize Soils
Polyacrylamide (BMP C126)

Element #6 - Protect Slopes
Straw Wattles (BMP C235)
Surface Roughening (BMP C240)

Element #8 - Stabilize Channels and Outlets
Level Spreader (BMP C206)
Check Dams (BMP C207)

Element #9 – Control Pollutants
Concrete Handling (BMP C151)
Construction Stormwater Chemical Treatment (BMP C250)
Construction Stormwater Filtration (BMP C251)

Element #10 - Control Dewatering
Vegetated Filtration (BMP C236)
Additional Advanced BMPs to Control Dewatering:

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Appendix D – General Permit

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Appendix E – Site Inspection Forms (and Site Log)

The results of each inspection shall be summarized in an inspection report or checklist that is entered into or attached to the site log book. It is suggested that the inspection report or checklist be included in this appendix to keep monitoring and inspection information in one document, but this is optional. However, it is mandatory that this SWPPP and the site inspection forms be kept onsite at all times during construction, and that inspections be performed and documented as outlined below.

At a minimum, each inspection report or checklist shall include:

a. Inspection date/times

b. Weather information: general conditions during inspection, approximate amount of precipitation since the last inspection, and approximate amount of precipitation within the last 24 hours.

c. A summary or list of all BMPs that have been implemented, including observations of all erosion/sediment control structures or practices.

d. The following shall be noted:

    i. locations of BMPs inspected,

    ii. locations of BMPs that need maintenance,

    iii. the reason maintenance is needed,

    iv. locations of BMPs that failed to operate as designed or intended, and

    v. locations where additional or different BMPs are needed, and the reason(s) why

e. A description of stormwater discharged from the site. The presence of suspended sediment, turbid water, discoloration, and/or oil sheen shall be noted, as applicable.

f. A description of any water quality monitoring performed during inspection, and the results of that monitoring.

g. General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.

h. A statement that, in the judgment of the person conducting the site inspection, the site is either in compliance or out of compliance with the terms and conditions of the SWPPP and the NPDES permit. If the site inspection indicates that the site is out of compliance, the inspection report shall include a summary of the remedial actions required to bring the site back into compliance, as well as a schedule of implementation.

i. Name, title, and signature of person conducting the site inspection; and the following statement: “I certify under penalty of law that this report is true, accurate, and complete, to the best of my knowledge and belief”.

When the site inspection indicates that the site is not in compliance with any terms and conditions of the NPDES permit, the Permittee shall take immediate action(s) to: stop, contain, and clean up the unauthorized discharges, or otherwise stop the noncompliance; correct the problem(s); implement appropriate Best Management Practices (BMPs), and/or conduct maintenance of existing BMPs; and achieve compliance with all applicable standards and permit conditions. In addition, if the noncompliance causes a threat to human health or the environment, the Permittee shall comply with the Noncompliance Notification requirements in Special Condition S5.F of the permit.

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Site Inspection Form

General Information

Project Name:

Inspector Name: **Title:**
CESCL # :

Date: **Time:**

Inspection Type:
- ☐ After a rain event
- ☐ Weekly
- ☐ Turbidity/transparency benchmark exceedance
- ☐ Other

Weather

Precipitation Since last inspection In last 24 hours

Description of General Site Conditions:

Inspection of BMPs

Element 1: Mark Clearing Limits

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

Element 2: Establish Construction Access

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

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Element 3: Control Flow Rates

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

Element 4: Install Sediment Controls

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

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Element 5: Stabilize Soils

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

Element 6: Protect Slopes

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

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Element 7: Protect Drain Inlets

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

Element 8: Stabilize Channels and Outlets

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

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Element 9: Control Pollutants

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

Element 10: Control Dewatering

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

BMP:

Location	Inspected		Functioning			Problem/Corrective Action
	Y	N	Y	N	NIP	

Stormwater Discharges From the Site

	Observed?	Problem/Corrective Action

	Y	N
Location		
Turbidity	☐	☐
Discoloration	☐	☐
Sheen	☐	☐
Location		
Turbidity	☐	☐
Discoloration	☐	☐
Sheen	☐	☐

Water Quality Monitoring

Was any water quality monitoring conducted? ☐ Yes ☐ No

If water quality monitoring was conducted, record results here:

If water quality monitoring indicated turbidity 250 NTU or greater; or transparency 6 cm or less, was Ecology notified by phone within 24 hrs?

☐ Yes ☐ No

If Ecology was notified, indicate the date, time, contact name and phone number below:

Date:

Time:

Contact Name:

Phone #:

General Comments and Notes

Include BMP repairs, maintenance, or installations made as a result of the inspection.

Were Photos Taken? ☐ Yes ☐ No

If photos taken, describe photos below:

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Appendix F – Engineering Calculations

Engineering calculations provided in Appendix B of the Technical Information Report

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APPENDIX F

Environmental Documentation

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CRITICAL AREAS REPORT & BUFFER MITIGATION PLAN

Project:

The Reserve at Green Mountain

Applicant:

Pacific Lifestyle Homes
11815 NE 99th Street,
Vancouver WA, 98682

Prepared By:

Ash ECO
SOLUTIONS, LLC

May 1 , 2025

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The information in this report was compiled to meet the requirements of the City of Camas Municipal Code (CMC) Sections 16.53 Wetlands and 16.61 Fish and Wildlife Habitat Conservation Areas. This report has been prepared under the supervision and direction of the undersigned, a qualified professional following CMC Section 16.61.020.A.

Andrea W. Aberle

Andrea W. Aberle, Sr. Biologist
AshEco Solutions, LLC

SITE INFORMATION:

Parcel No(s):	173192000
Acreage:	11.67 acres
Local Jurisdiction:	City of Camas, Washington
Section/Township/Range:	SW¼, S21, T2N, R3E, W.M.
Site Address:	2625 Goodwin Road Camas, WA 98607
Legal Landowner:	Marwan Bahu

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INTRODUCTION

Project Description

AshEco Solutions, LLC (AES) was contracted by Pacific Lifestyle Homes (PLH) to assess the potential critical areas present within the subject parcel that comprises the proposed subdivision site and develop a mitigation plan to offset project impacts. This Critical Areas Report and Buffer Plan follows the City of Camas Municipal Code (CMC) Sections 16.53 Wetlands and 16.61 Fish and Wildlife Habitat Conservation Areas. PLH proposes construction of 38-lot single family residence subdivision within a parcel of land comprised of 11.67-acres.

Project Location and Background Information

The subject parcel addressed as 2625 Goodwin Road, Camas, Washington (Figure 1), is under the jurisdiction of the City of Camas and is assigned Parcel Number 173192000. The site is surrounded to the east and west by large residential and agricultural lots. North of the property is urban residential lots and south of the property is forest park land owned by Clark County.

EXISTING CONDITIONS

A single-family residence is located within the southern section of the subject parcel. A large accessory building/shop, and another smaller accessory building adjacent to the larger building, are present within the northern section of the property. The residence is accessed from NE Goodwin Road from a paved and gated driveway. Topography, onsite and in the vicinity of the site, consistently falls in elevation from NE Goodwin Road in the north to the south/southwest offsite. Seasonal hydrology ultimately flows southwest to the valley floor where Lacamas Creek is located offsite. A constructed pond is located in the southwest parcel corner inside the wetland boundary onsite. Scattered individual trees, and groups of trees, including Oregon white oak are present throughout the subject parcel. However, otherwise the parcel is generally open, with the northern section historically used for equine and agricultural purposes and the south reserved for the existing residence and expansive lawn area that surrounds it. Little native understory exists within the bulk of the parcel due to a history of grazing of the open pastures and maintained lawn present surrounding the residence. Forested habitat becomes predominant near the southern parcel boundary as the subject parcel abuts Clark County owned lands located directly south of the subject site. It should be noted that a series of trails and a maintained access/logging road is present to the south on the county property with connection ultimately south to Lacamas Lake and Camp Currie park lands.

CRITICAL AREAS MAP RESEARCH

Topography

Topography generally consists of a south facing slope on a terrace above the Lacamas Creek valley. Topography maps show that the overall area drops in elevation from Goodwin Road to the south (Figure 2).

Soil Survey

Soils within the subject parcel are mapped by the NRCS USDA Soil Conservation Service, Soil Survey of Clark County Washington (1972), as Lauren gravelly loam, cemented substratum, 3 to 15 percent slopes (LrC), Cove silty loam, 0 to 3 percent slopes (CvA), and Dollar loam, 0 to 5 percent slopes (DoB) (Figure 3).

The Lauren series consists of deep, somewhat excessively drained, nearly level to gently sloping soils on terraces 50 to 300 feet above the Columbia River. In a few places, on terrace fronts, the soils are steep to very steep. These are very gravelly soils that formed in mixed Columbia River alluvium that contained some volcanic ash. Lauren soils are in the southwestern part of the county, in the vicinity of Mill Plain, Orchards, and Fourth Plain. The original vegetation was Douglas-fir, grand fir, bigleaf maple, vine maple, salal, and ferns. The average annual precipitation is about 48-inches.

Lauren loam, cemented substratum, 3 to 15 percent slopes (LrC) is similar to Lauren gravelly loam, 0 to percent slopes, except that the cementation in this soil is outside the defined range for this soil series. In a typical profile the surface layer is about 14 inches thick. It is very dark brown gravelly loam in the upper part, and very dark brown grayish-brown gravelly clay loam in the lower part. Below the surface layer is firm, dark brown very gravelly clay loam about 21 inches thick. The next layer, to a depth of 60 inches, is dark yellowish-brown very gravelly clay loam. It is weakly cemented. This soil is moderately well drained, surface runoff is slow to medium and the erosion hazard is slight to moderate. Native Oregon white oak and Oregon ash are the predominate with native trees present within this soil series, with Douglas fir predominate in the better drained areas. The Lauren loam 3 to 15 percent slopes is not listed as a hydric soil by the Washington State Hydric Soils List for Clark County (NRCS 2022).

The Cove series consists of deep, very poorly drained, mostly nearly level soils. These soils formed in water-laid deposits in old lakes and ponds and have a clayey subsoil. Typical native vegetation is deciduous trees, sedges, reeds, and water-tolerant shrubs and grasses. Cove

Cove silty loam, 0 to 3 percent slopes (CvA), is found in concave drainageways and in large, flat, old lakebeds. The slope is generally less than 1 percent. In a typical profile the surface layer is very dark graysilty clay about 4 inches thick. Below this is firm clay about 32 inches thick. It is black in the upper part and very dark gray and mottled in the lower part. The underlying material, to a depth of 54 inches, is mottled, light olive-gray gravelly silty clay loam. This soil is very poorly drained and very slowly permeableSurface runoff is very slow, and ponding is common in winter unless drainage is provided. There is no hazard of erosion. The CvA 0 to 3 percent slopes soil type is listed on the Washington State Hydric Soils List for Clark County (NRCS 2022). AES does not agree with the hydric soils mapping over the subject site entirely, but wetlands were identified near the western parcel boundary and the southwest corner of the subject site (Figures 3 and 8).

The Dollar series consists of deep, moderately well drained, nearly level to gently sloping soils. These are medium textured soils that developed in deposits of old Columbia River alluvium. They are on low terraces that adjoin the poorly drained, depressional McBee, coarse variant, soils and the Cove soils. Typical native vegetation is mainly Douglas-fir, grand fir, and some western redcedar, and an understory comprised of salal, Oregon grape, vine maple, and ferns. In areas of transitional to wet soils, the vegetation is red alder and Oregon ash.

Dollar loam, 0 to 5 percent slopes (DoB) can be identified easily by its slightly raised relief with scattered stands of Douglas-fir. In a typical profile the surface layer is dark-brown loam about 6 inches thick. Below this is friable heavy loam about 26 inches thick. It is dark reddish brown in the upper part and dark brown in the lower part. The next layer, to a depth of 60 inches, is very firm and brittle, dark yellowish-brown heavy loam. This soil is moderately well drained. Surface runoff is slow, and the erosion hazard is slight. The DoB soil type is not listed on the Washington State Hydric Soils List for Clark County (NRCS 2022).

Mapped hydric soils do not necessarily mean that the area is a wetland; hydrology and wetland vegetation must be present to classify an area as a wetland. The same is true for soils that are not mapped as hydric. Wetlands can be found in areas without mapped hydric soils.

Wetlands

Potential wetland presence is mapped within the southwest corner of the parcel by the Clark County GIS MapsOnline (Figure 3). The National Wetland Inventory (NWI) also maps wetlands within the same general area

(Figure 3). Wetlands were identified within the subject parcel by AshEco Solutions (AES) near the western property line and far southwest portion of the site (Figure 8). An additional offsite wetland was also mapped just offsite from the southeastern property corner, Figure 8.

Riparian Habitat

Clark County GIS does not map Riparian Habitat onsite (Figure 4). Within the southeast corner of the subject parcel AES identified an unnamed seasonal, non-fish bearing (Type Ns) stream (Figures 8 and 9). The stream is not mapped by the WA State Department of Natural Resources (DNR) Forest Practices Application Review System (FPARS) (Figure 7).

Shorelines

An offsite Type S Water (Lacamas Creek) is located approximately 0.25 miles southwest of the subject parcel. Type S Waters are considered Shorelines of the State and governed by the City of Camas and Washington State Department of Ecology (ECY). The "Urban Conservancy" shoreline designation is mapped by the Clark County GIS shoreline layer as intruding into the southwest parcel corner, which roughly corresponds with the location of the onsite portion of Wetland A (Figure 5 and Figures 8-9). Wetland A is therefore considered to be an "associated wetland" to the shoreline and governed by the local SMP. The project does not propose direct impacts to this associated wetland to the shoreline and has applied the standard wetland buffer widths as required by the local code.

WDFW Priority Habitat

The Washington Department of Fish and Wildlife (WDFW) maps Oregon white oak habitat within the southeast corner of the subject parcel, Figure 4. AES identified Oregon white oak habitat onsite, both within the southeast corner as well as the central portion of the site. AES also mapped individual oaks onsite in areas not previously mapped by WDFW, Figure 8.

WDFW also indicates that "Cave or Cave-rich Areas" occur within the general area surrounding the subject parcel, though no evidence of caves or rock outcroppings were identified onsite by AES during site reconnaissance.

No riparian habitat was mapped by WDFW, DNR or Clark County GIS within the subject parcel however AES did identify a short section of seasonal stream that contained a well-defined stream channel. It appears this channel conveys seasonal hydrology between the two wetlands mapped by AES during storm events, Figure 8.

METHODOLOGY

Wetlands

The study area and immediate offsite vicinity was evaluated for the presence of wetlands using the Routine Determination Method per the U.S. Army Corps of Engineers' (USACE's) *Wetland Delineation Manual* (1987), the *Washington State Wetlands Identification and Delineation Manual* (1997), and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region, Version 2.0* (USACE 2010). The Routine Determination Method examines three parameters to determine if wetlands exist in a given area: vegetation, hydrology, and soils. The presence of hydrology is critical in identifying wetlands; however, since hydrologic conditions can change periodically (hourly, daily, or seasonally), it is necessary to determine if hydrophytic vegetation and hydric soils are also present. By definition, wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of

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vegetation typically adapted for life in saturated soil conditions. Wetlands are regulated as “Waters of the United States” by the USACE, “Waters of the State” by Washington State Department of Ecology (ECY), and locally by CMC section 16.53 Wetlands. Wetlands were identified by AES in the southwest corner of the subject parcel (extending offsite to the west), and just offsite from the southeast corner of the subject parcel, Figure 8.See Appendix B for formal test plot data collected onsite by AES. See Appendix A for representative site photos.

Riparian Habitat

The methodology used for determining the location of the OHWM of the unnamed seasonal, non-fish bearing (Type Ns) stream followed the Washington State Department of Ecology’s (ECY) Determining the OHWM on Streams in Washington State (2010). See Appendix A for representative site photos.

WDFW Priority Habitat

The subject site was evaluated for the presence of Priority Habitats as defined by WDFW Priority Habitats and Species (PHS) List 2008. WDFW PHS system maps Oregon white oak habitat onsite and adjacent to the subject parcel and the PHS system indicates that “Cave or Cave-rich Areas” occur in areas surrounding the subject parcel (Figure 6).

WDFW defines Caves as, *“A naturally occurring cavity, recess, void, or system of interconnected passages (including associated dendritic tubes, cracks, and fissures) which occurs under the earth in soils, rock, ice, or other geological formations, and is large enough to contain a human. Mine shafts (a human-made excavation in the earth usually used to extract minerals) may mimic caves and abandoned mine shafts with actual or suspected occurrences of priority species should be treated in a manner similar to caves.”*

WDFW defines Oregon White Oak Woodlands as, “*stands of oak or oak/conifer associations where canopy coverage of the oak component of the stand is 25%; or where total canopy coverage of the stand is <25%, but oak accounts for at least 50% of the canopy coverage. The latter is often referred to as oak savanna. In non-urbanized areas west of the Cascades, priority oak habitat consists of stands > 0.4 ha (1.0 ac) in size. East of the Cascades, priority oak habitat consists of stands > 2 ha (5 ac) in size. In urban or urbanizing areas, single oaks or stands < 0.4 ha (1 ac) may also be considered a priority when found to be particularly valuable to fish and wildlife (i.e., they contain many cavities, have a large diameter at breast height [dbh]* (generally 20-inches dbh and greater), *are used by priority species, or have a large canopy). Oak woodlands in western Washington may contain understory plants indicative of Prairie*.”

No caves were identified onsite or immediately offsite near the subject parcel. Oregon white oak habitat consisting of individual oak trees were identified within or immediately adjacent to the subject parcel (Figure 8). The subject site is within an incorporated city and is urban, therefore the individual Oregon white oak trees are considered Priority Habitat by WDFW. There are areas onsite where the oak trees are more densely populated and/or located within areas of shared Douglas-fir canopy, but these areas do not meet the above definition for oak woodland or savanna. The outer dripline of the canopy for the individual oak trees measuring 20-inches dbh or greater onsite were therefore mapped and professionally surveyed by PLS Engineering, Figures 8-10 and Appendix D. See Appendix A for representative site photos. The project does not propose impacts to the onsite oak habitat. The wetland buffer mitigation plan includes the restoration and enhancement of the onsite oak habitat, Figure 9

Habitats of Local Importance

Following CMC Chapter 16.61 - Fish And Wildlife Habitat Conservation Areas, Section: 16.61.010.A.3.a,

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individual Oregon white oak trees with a twenty-inch diameter at breast height (20-inches dbh), stands of Oregon white oak trees greater than one acre when they are found to be valuable to fish and wildlife (i.e., may include trees with cavities, large diameter breast height¸ are used by priority species, or have a large canopy), and all Oregon white oak snags unless determined by an arborist to be a hazard, are considered Habitats of Local Importance and therefore are regulated by CMC. The tree survey identified approximately sixteen (16) jurisdictional Oregon white oak trees onsite that had greater than 20-inch dbh measurements, See Appendix D.

DOCUMENTED VEGETATION

The vegetation onsite has been disturbed by equestrian use and historic mowing activities, with non-native and invasive grasses and herbs dominate throughout areas historically grazed within the northern and central sections of the parcel. Scattered trees present within the onsite central section include Douglas-fir (*Pseudotsuga menzisii* FACU) and Oregon white oak (*Quercus garryana* FACU).

South of the subject parcel is a forested wetland mosaic area owned by Clark County. This area is much more biologically diverse and slightly overlaps with onsite areas along the southern parcel boundary and corners. Vegetation identified in this area includes Douglas-fir (*Pseudotsuga menzisii* FACU), Oregon white oak (*Quercus garryana* FACU), and Oregon ash (*Fraxinus latifolia* FACW) in the overstory with vine maple (*Acer circinatum* FAC), beaked hazelnut (*Corylus cornuta* FACU), snowberry (*Symphoricarpos albus* FACU), red osier dogwood (*Cornus sericea* FACW), trailing blackberry (*Rubus ursinus* FACU) and salmonberry (*Rubus spectabilis* FAC) in the shrub stratum and sword fern (*Polystichum munitum* FACU), piggy-back plant (*Tolmiea menzisii* FAC), lanceleaf spring beauty (*Claytonia lanceolata* FAC), dovefoot geranium (*Geranium mole* FACU), large leaf avens (*Geum macrophyllum* FACW), and slough sedge (*Carex obnupta* OBL) in the herbaceous stratum.

The indicator categories following the common and scientific name of each vegetation species indicate the likelihood of the species to be found in wetlands. Listed from most-likely to least-likely to be found in wetlands, the indicator categories are:

- **OBL (obligate wetland) –** Occur almost always under natural conditions in wetlands.
- **FACW (facultative wetland) –** Usually occur in wetlands but occasionally found in non-wetlands.
- **FAC (facultative) –** Equally likely to occur in wetlands or non-wetlands.
- **FACU (facultative upland) –** Usually occur in non-wetlands but occasionally found in wetlands.
- **UPL (obligate upland) –** Occur almost always under natural conditions in non-wetlands.
- **NI (no indicator) –** Insufficient data to assign to an indicator category.

CRITICAL AREA CONCLUSIONS

Wetlands

AES identified two wetlands, one partially located onsite and the second located just offsite. Wetland Ais located near the western parcel boundary and within the southwest parcel corner and continues offsite to the west (Figures 8 and 9). Wetland A was rated under the Slope Hydrogeomorphic Classification (HGM) and is considered a Category II wetland that scored high on for habitat functions (8), Appendix C. Wetland B is located just offsite from the southeastern corner of the parcel and was rated under the Depressional HGM classification due to the large area of ponding observed. Wetland B rated as a Category II wetland with a habitat functions score of 8 (Appendix C).

Wetland Buffers

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Under the Camas Municipal Code (CMC), wetland buffer widths are established by comparing the wetland rating habitat function score and overall category, and the intensity of proposed land use. Under CMC Table 16.53.040-4 residential use with density higher than 1-unit per acre is considered High Land Use Intensity (LUI). The proposed 38-lot single family residential subdivision will match the current zoning, Single-Family Residential (R-7.5) of the subject parcel comprised of 11.67 acres. The proposed density of the subdivision meets the definition of High LUI under the CMC. Under CMC Table 16.53.040-2, Category II wetlands with a habitat function score of 8 adjacent to proposed High LUI require 260-foot buffers, 195-foot buffers for Moderate LUI, and 130-foot buffers for Low LUI.

Riparian Habitat

Within the southeast corner of the subject parcel AES identified an unnamed seasonal, non-fish bearing (Type Ns) stream (Figures 8 and 9). Type Ns streams require a 25 ft riparian buffer under CMC 16.61.040.D. The areas flanking this stream to the north and south reflect upland conditions. It appears that seasonal hydrology flows from east to west have over time carved out a defined channel within this location.

WDFW Priority Habitat

Oregon white oak woodland and individual Oregon white trees were identified onsite and immediately offsite (Figures 8 and 9). Oregon white oak Priority Habitat is protected by WDFW and also jurisdictional under the local CMC habitat code. The understory and herbaceous layer associated with the onsite oak habitat is highly disturbed due to grazing, lawn mowing or areas dominated by Himalayan blackberry. The dripline of each oak tree canopy was located by survey and is depicted on Figure 8.

Table 1. Critical Areas Summary.

Critical Area	Buffer Width	
Wetland A Category II Wetland (Habitat Score: 8)	***Standard Wetland Buffer***	***LUI Wetland Buffer Reduction***
	260 ft = High LUI Buffer	195 ft = Moderate LUI Buffer
Type Ns Stream	25 ft Riparian Buffer	

BUFFER MITIGATION PLAN

The buffer mitigation plan was developed following Camas Municipal Code CMC) Sections 16.53 Wetlands to offset the project impacts proposed and allow for no net loss of habitat functions onsite.

Avoidance and Minimization

The construction of this residential subdivision within the appropriate zoning location will provide housing for the southwest Washington market, specifically high density residential within the City of Camas where the market demand is high. Following the mitigation sequencing, the project has avoided and minimized impacts to the full extent practicable while still meeting the required design and engineering elements for a subdivision of this size. To utilize the subject site to the fullest following the zoning defined by the city, a large footprint is required to allow for the residential lots, required stormwater facility, internal roadways and the development entrance/exit adequate to accommodate the subdivision. However, the subject site is highly constrained due to due to Category II wetlands and Oregon white oak habitat (Figures 8 and 9).

Despite the large constraints that the critical areas impose, the proposed project has been designed to avoid direct impacts to the wetlands, Oregon white oak habitat, and the highest functioning mature forested buffer habitat present onsite. Additionally, the project proposes extensive wetland buffer enhancement and Oregon

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white oak habitat restoration – including habitat corridor connectivity between these historically separated habitats. Therefore, the unavoidable impacts will be offset with adequate mitigation onsite for no net loss of habitat function or values.

The offsite portion of the Wetland A unit provides moderately high to high functions. However, the onsite portion of Wetland A has had historic impacts due to excavation to create a pond within the wetland. The buffer habitat onsite within the southwestern corner of the subject parcel has also been degraded by historic agricultural use/grazing, mowing and is generally dominated by monotypic vegetation including invasive reed canarygrass, lawn grasses, and non-native Himalayan blackberry. This has resulted in a lack of biodiversity and special habitat features, with minimal plant community structure for the onsite wetland and buffer. The project has shown avoidance and minimization of impacts by avoiding direct impacts to the highest functioning buffer habitat and oak habitat while utilizing the historically impacted areas of the subject site for development (existing building footprints, parking and driveway areas, maintained lawn areas, and historic agriculture fields that have been highly managed over the history of the site due to equestrian use). The southern and southwest areas of the subject site are the most constrained due to the significant wetland buffers and oak habitat located in this area. These critical areas highly constrain this portion of the site, thereby making full use of this open area impossible without buffer impacts of some degree. Where the site is less constrained in the east, the project was designed to hold the standard base wetland buffer widths (Figure 9).

The proposed single-family residence subdivision has been designed to avoid onsite critical areas to the extent possible while still providing a residential subdivision meeting the density and design requirements required by the City of Camas. The onsite wetland, stream buffer, and Oregon white oak habitat present have been avoided by the proposed development. However, with the majority of the southern subject parcel encumbered by a substantial wetland buffer (260 feet), impacts to this buffer area are unavoidable. Therefore, the project proposes to modify the buffer area over an area of historically impacted and maintained lawn surrounding the existing house in the southwest portion of the subject parcel.

Wetland Buffer Reduction

CMC 16.53.050.C.1.a.i-ii allows the standard High LUI wetland buffer width (260 ft) to be reduced to the Moderate LUI buffer (195 ft) if a relatively undisturbed corridor at least 100-ft feet wide is protected between the wetland and any other priority habitats present (as defined by the WDFW) and measures to minimize the impacts of the land use adjacent to the wetlands are applied.

In addition to the wetland and buffer habitat identified onsite, Oregon white oak habitat is present onsite and is classified by WDFW as a priority habitat (Figures 8 and 9). Though there are portions of Wetland A offsite that provide moderate to high functions due the scrub-shrub and forested habitat present, the onsite portions of the onsite wetland buffer habitat is degraded from historic residential mowing and overall lacks diversity of the vegetation and habitat structure. The project proposes reduction of the 260 ft High LUI wetland buffer to the 195 ft Moderate LUI buffer by establishing 100 ft minimum corridor between Category II wetlands and the onsite Oregon white oak priority habitat (Figure 9). In many areas the proposed corridor exceeds 100 ft width, see Figure 9. The proposed habitat corridor connectivity is quite extensive, as it will essentially connect the central oak habitat west and south to the Wetland A buffer, then continue east connecting to the Wetland B buffer and multiple individual oak trees present within this area along the eastern property line.

Additionally, the restoration of the central oak habitat area is proposed as the existing asphalt driveway will be removed and be replaced with native vegetation/understory enhancement. By removing this section of paved driveway, an even more extensive habitat corridor connection between the onsite oak habitat and the wetland will be provided as the driveway has acted to fragment this oak habitat for many years.

The project has also been designed to minimize the impacts of the land use adjacent to the wetlands in accordance with CMC 16.53.050.C.1.a.ii. The proposed project includes stormwater infiltration and has been designed so that development is located outside of areas currently dominated by native vegetation, areas of mature native forested buffer vegetation and the Oregon white oak habitat present onsite. The development has also been designed to be located as far as possible from the onsite wetland to avoid and minimize noise and light directed to the wetland. After implementing the above buffer reduction allowance, the modified base buffer width is considered to be the Moderate LUI buffer or 195 feet.

Wetland Buffer Impacts to the Modified Buffer

After modifying the standard buffer from 260 feet to 195 feet and applying the above outlined avoidance and minimization measures to the onsite critical areas, the project will have unavoidable impacts to two portions of the outer 195-foot wetland buffer over a total area of 25,983 sf. These impact areas can be offset by enhancement over 74,831 sf of the adjacent buffer at a 2.88:1 ratio to the impact area, Figure 9. As outlined by CMC, buffer reduction is allowed over degraded areas when invasive species removal (of the Himalayan blackberry present) and native enhancement is provided to offset the potential loss of buffer functions and values.

Wetland Buffer Impacts due to Stormwater Facility

To allow for the stormwater pond within the buffer of the Category II wetland with a high habitat score (8), additional buffer impacts and mitigation are proposed. Even though the offsite portions of the wetland unit provide higher functions, this onsite buffer area where the stormwater facility is proposed is degraded and consists of monotypic lawn grasses with no significant vegetation to be impacted. The area of buffer impact imposed by the stormwater facility has been quantified to be 11,010 sf, Figure 9. The project proposes to offset this buffer impact area at approximately a 1.24:1 ratio by buffer averaging nearby (and north of the standard 260-foot base buffer width otherwise held by the project along the eastern property boundary) over an area totaling 13,698 sf in size, Figure 9.

Additionally, this buffer averaging area (as well as the adjacent buffer to the south) will be enhanced resulting in a 3:1 mitigation ratio to the impacts. A total of 33,030 sf of buffer habitat will be enhanced and when combined with the averaging area (which exceeds the standard 1:1 ratio) these mitigation measures will ensure that the construction of the stormwater facility within the outer portion of the Category II buffer will have no net loss of buffer area or functions. Additionally, the area surrounding the stormwater facility to the south will be enhanced as it is part of the overall buffer enhancement previously outlined. Under CMC 16.53.050.2, wetland buffer averaging is allowed in conjunction with other reductions in buffer width.

This buffer averaging and enhancement area also contains individual Oregon white oak habitat that can be connected to the central and southern oak habitat/wetland buffer vegetated corridor when combined with the native buffer enhancement activities allowing for the maximum onsite corridor connection possible between the various habitats.

Habitat Enhancement Summary

In total, the habitat enhancement proposed will cover 126,908 sf. This total enhancement area is comprised by the onsite wetland buffer areas totaling 107,861 (74,831 sf + 33,030 sf) and the Oregon white oak habitat restoration area of 19,047 sf. See Table 2 for a detailed summary of the proposed impacts and mitigation. By

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enhancing this entire wetland buffer habitat with native trees and shrubs, it will not only upgrade the diversity of the vegetation and structure from the existing lawn, but it will provide a vegetated habitat corridor connection between all the critical areas; Wetlands A and B, Type Ns stream, and Oregon white oak habitat where no connection has historically been present. The buffer enhancement will include the addition of Oregon white oak trees, as well as other native trees and understory shrubs commonly found within oak woodland habitat. This will ultimately create a habitat that will meet the WDFW oak woodland criteria and will upgrade the buffer functions including shielding, habitat and overall diversity to the degraded buffer habitat onsite. As a result the mitigation proposed will provide greater connectivity for wildlife habitat, by increasing shade, shelter, and food sources within multiple locations onsite while also providing greater contiguous habitat corridor connections to the offsite forested wetland (Wetland A) associated with the Lacamas Creek habitat corridor.

Table 2. Impacts & Mitigation Summary.

Critical Area	Impact	Mitigation (Area) 107,861 sf.
Wetlands A & B Buffer Habitat	Buffer Reduction from High to Mod Buffer	**Provide Native Vegetated Corridor Connection Between Category II Wetlands and WDFW PHS** (minimum 100' in width) *Native enhancement of onsite wetland buffers to connect to Oregon white oak habitat* ***Total Habitat Corridor Enhancement Area:*** *"Wetland Buffer" (107,861 sf)* *+* *"Oak Restoration Area" (19,047 sf)* ***= 126,908 sf***
		Oak Habitat Restoration Area *Removal of Exist. Driveway & Native Enh.* (19,047 sf)
	Lot Impact to 195' Buffer **(25,983 sf)**	**Buffer Enhancement** @ 2.88:1 Ratio **(74,831 sf)**
	Stormwater Pond Impact to 195' Buffer **(11,010 sf)**	Buffer Averaging @ 1.24:1 Ratio (13,698 sf)
		Combined w/ Buffer Enhancement (Averaging area and adjacent buffer) @ 3:1 Ratio **(33,030 sf)**

Note: The total "Wetland Buffer Enhancement" Area includes (74,831 sf + 33,030 sf) = 107,861 as depicted by the aqua hatch on Figure 9.

PLANTING PLAN

Site Preparation

1. Stake or flag the on-site mitigation area boundaries and install tree protection fencing if necessary.

2. Aggressively mow grasses and/or remove invasive species present within the mitigation area prior to planting, paying particular attention to the removal and control of any Himalayan blackberry as requried.

Plant Materials

The plants specified for the buffer mitigation are native species designed to diversify the existing plant community, provide an increase in woody structure and wildlife habitat on a short- and long-term basis, thereby increasing the ecological functions of the riparian habitat. The specified shrubs will grow quickly, forming an intertwining understory layer within the mitigation areas, and over time the specified trees will provide structural and biological diversity.

Container Stock

Plants will be purchased from a native-plant nursery and meet size specifications outlined under the planting plan, see Table 3.

Bareroot Species

1. Plants will be purchased from a native plant nursery and meet size specifications outlined under the planting plan, see Table 3.
2. Bareroot sock will be kept cool and moist prior to being planted.
3. Bareroot stock will have well-developed roots and sturdy stems with a good root-to-shoot ratio.
4. No damaged or desiccated roots or diseased plants will be used.
5. Unplanted bareroot stock will be stored properly at end of planting day(s) to prevent desiccation.

Planting Methods

Plant in fall through early spring (October-April) at specified spacing following the planting plan.

Container/bareroot stock

1. Dig hole using a tree shovel/auger or comparable tool 16-inches wide and 4-inches deeper than the root system, scarify sides of hole to 4 inches. Remove plant from container and loosen roots with hand or score vertically on sides and bottom with knife. Set plant upright and plumb in hole so the crown is just above the finish grade. Ensure that roots are extended down entirely and do not bend upward.
2. Replace loose soil around plant and firmly compact the soil around the plant to eliminate air spaces. Do not use frozen soil for backfilling.
3. Firmly compact the soil around the planted species to eliminate air spaces.
4. Install woody mulch around the base of planted species to insulate plantings, maintain moisture content of soil and reduce invasive plant competition (when deemed necessary).
5. Irrigate according to performance standards for the first three summers after planting or as site and weather conditions warrant.

Planting Specifications

Planting will begin in Fall of 2025, or Winter/Spring of 2026 or Fall of 2026, while onsite soils are saturated (and stock is dormant). The following tables summarize the native plant selection, spacing, size, and quantity for the on-site mitigation area:

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Table 3. Native Planting Plan.

Wetland Buffer Enhancement 107,861 sq. ft.				
Common Name	*Scientific Name*	*Stock*	*Spacing*	*Quantity*
Trees				
Oregon white oak	*Quercus garryana*	1-gallon or 24-36” bare-root	20 ft.	50
Douglas fir	*Pseudotsuga menziesii*	1-gallon or 24-36” bare-root	10 ft.	100
Big leaf maple	*Acer macrophyllum*	1-gallon or 24-36” bare-root	10 ft	100
Bitter cherry	*Prunus emarginata*	1-gallon or 24-36” bare-root	10 ft.	100
			Trees =	350
Shrubs				
Beaked hazelnut	*Corylus cornuta*	1-gallon or 24-36” bare-root	6 ft.	150
Nootka rose	*Rosa nutkana*	1-gallon or 24-36” bare-root	6 ft.	200
Ocean spray	*Holodiscus discolor*	1-gallon or 24-36” bare-root	6 ft.	100
Serviceberry	*Amelanchier alnifolia*	1-gallon or 24-36” bare-root	6 ft.	100
Snowberry	*Symphoricarpos albus*	1-gallon or 24-36” bare-root	6 ft.	200
Vine maple	*Acer circinatum*	1-gallon or 24-36” bare-root	6 ft.	100
			Shrubs =	850
			Grand Total =	**1,200**
Oregon White Oak Habitat Restoration 19,047 sq. ft.				
Common Name	*Scientific Name*	*Stock*	*Spacing*	*Quantity*
Trees				
Bitter cherry	*Prunus emarginata*	1-gallon or 24-36” bare-root	10 ft.	10
Cascara	*Frangula purshiana*	1-gallon or 24-36” bare-root	10 ft.	10
			Trees =	20
Shrubs				
Beaked hazelnut	*Corylus cornuta*	1-gallon or 24-36” bare-root	6 ft.	35
Nootka rose	*Rosa nutkana*	1-gallon or 24-36” bare-root	6 ft.	35
Oceanspray	*Holodiscus discolor*	1-gallon or 24-36” bare-root	6 ft.	35
Serviceberry	*Amelanchier alnifolia*	1-gallon or 24-36” bare-root	6 ft.	35
Snowberry	*Symphoricarpos albus*	1-gallon or 24-36” bare-root	6 ft.	50
			Shrubs =	190
			Grand Total =	**210**

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<table>
<tr><th colspan="2">Oak Restoration Driveway Removal Area Seeding :</th></tr>
<tr><th>Native Uplands Mix</th><th>Recommended Seeding Rate</th></tr>
<tr><td>Mix Includes:
California Brome - Bromus carinatus
Blue Wildrye - Elymus glaucus
Streambank Lupine - Lupinus rivularis
Western Yarrow - Achillea millefolium</td><td>1 lb. per 1,000 square feet</td></tr>
</table>

Notes:
1. The "Native Uplands" mix can be sourced from Sunmark Seeds. An adequate substitution is the "Native Upland Mix with Color" sourced from ProTime (PT 404).
2. (Buffer Reduction Area in Mod LUI Buffer (25,983 sf.) Mitigated for by Buffer Enhancement @ 2.88:1 ratio to Impacts or 74,831 sf.)(Storm Water Pond (11,010 sf.) Mitigated for by Buffer Enhancement @ 3:1 ratio to Impacts or 33,030 sf.)

Maintenance Plan

Maintenance of the buffer mitigation area(s) is a five-year process and will involve removing persisting invasive plant species in addition to watering and re-installing failed native species as necessary. The maintenance will include the following activities when necessary:

1. Remove and control non-native/noxious vegetation around all newly installed plants. During years 1 through 3 invasive species will be removed and suppressed as often as necessary to meet a performance standard of no greater than 20 percent cover by invasive species, measured by monitoring plots.
2. Irrigate planted species as necessary during the dry season, approximately July 1 through October 15. Irrigation is recommended to occur on a two-week cycle (minimum) during the dry season for the first three years. Water will be provided by a temporary above-ground irrigation system or a water truck.
3. Replace dead or failed plants as described for the original installation to meet the minimum annual performance standard of 100% survival in the first year, 90% survival in the second year, and 80% survival in years 3-5.

Monitoring Plan

The buffer mitigation area(s) will be monitored for a 5-year period following project construction; monitoring will take place in years 1, 2, 3 and 5. Monitoring reports will be submitted to the City of Camas by the end of each monitored year. The goal of monitoring is to determine if the previously stated performance standards are being met. The mitigation area will be monitored once during the growing season, preferably during the same two-week period each year to better compare the data.

During the first annual monitoring and maintenance event, two representative photo plots will be selected in the mitigation areas permanently marked with metal posts. Monitoring photo plot locations will be placed on an as-built drawing and included in the annual monitoring reports.

Vegetation

Vegetative monitoring will document the woody scrub-shrub canopy developing within the mitigation area. The following information will be included at each sample plot:

- Percent cover and frequency of sapling/shrub species
- Species composition of herbs, shrubs, and trees, including non-native/noxious, invasive species

- Photo documentation of vegetative changes over time

Monitoring Report Contents
The annual monitoring reports will contain at least the following:

- Location map and as-built drawing.
- Photographs from permanent photo points (x2 minimum).
- Historic description of project, including dates of plant installation, current year of monitoring, and restatement of mitigation goal.
- Documentation of plant survival, cover, and overall development of the plant community.
- Assessment of non-native, invasive plant species and recommendations for management.
- Summary of maintenance and contingency measures proposed for the next season and completed for the past season.

Contingency Plan

If the performance standards are not met by the fifth year following project completion, or at an earlier time if specified above, a contingency plan will be developed and implemented. All contingency actions will be undertaken only after consulting and gaining approval from the City of Camas. The applicant will be required to complete a contingency plan that describes (1) the causes of failure, (2) proposed corrective actions, (3) a schedule for completing corrective actions, and (4) whether additional maintenance and monitoring are necessary.

Site Protection

The on-site mitigation area will be owned and managed by the applicant or assignee. AshEco Solutions, LLC or similar entity will be responsible for supervising the maintenance and conducting the monitoring of the on-site mitigation area for the 5-year period at expense of the applicant. The applicant will establish and record a permanent and irrevocable conservation covenant on the mitigation property.

MITIGATION GOALS, OBJECTIVES AND PERFORMANCE STANDARDS

Objective 1: Provide a native vegetated habitat corridor between the wetlands and Oregon white oak habitat, and enhance 107,861 sf of the wetland buffer with natives following Table 3.

Performance Standard 1a. Document the installation of the native plant species specified by Table 3. Submit As-built documenting planting locations, plant species, and plant quantities. *Site prep is to include the removal of invasive species as needed.*

Performance Standard 1b. In Year 1, planted species are to achieve 100 percent (100%) survival one year after the site is planted. The survival rate is to be determined by comparison of baseline vegetation data collected during production of the As-built Map. (If dead plants are replaced in Year 1 to achieve the 100 percent survival rate, this performance standard will be met).

Performance Standard 1c. In Year 2, mitigation plant communities will achieve the densities listed in Table 4.

Performance Standard 1d. In Year 5, the mitigation plant community will achieve 30-percent (30%) aerial cover of woody species. (If plants are added, that achieve this cover requirement, this performance standard will be met).

Performance Standard 1e. In All Years, non-native/invasive plant species will not exceed 20-percent (20%) aerial cover across the onsite mitigation area.

Objective 2: Provide the Oregon white oak habitat restoration over 19,047sf (as depicted on Figure 9) to provide full connectivity between the wetland and oak habitat onsite and enhance with natives as outlined in Table 3.
Performance Standard 2a. Document the removal of the existing paved driveway and the installation of the native grass seed within old driveway footprint and install native shrub species as specified by Table 3. Submit As-built documenting planting locations, plant species, and plant quantities.
Performance Standard 2b. In Year 1, planted species are to achieve 100 percent (100%) survival one year after the site is planted. The survival rate is to be determined by comparison of baseline vegetation data collected during production of the As-built Map. (If dead plants are replaced in Year 1 to achieve the 100 percent survival rate, this performance standard will be met).
Performance Standard 2c. In Year 2, mitigation plant communities will achieve the densities listed in Table 4.
Performance Standard 2d. In Year 5, the mitigation plant community will achieve 30-percent (30%) aerial cover of woody species. (If plants are added, that achieve this cover requirement, this performance standard is met).
Performance Standard 2e. In All Years, non-native/invasive plant species will not exceed 20-percent (20%) aerial cover across the onsite mitigation area.

Objective 3: Provide 13,698 sf buffer averaging area to offset the location of the stormwater facility within the buffer at a 1.24:1 ratio.
Performance Standard 3a. Document the buffer averaging area (as depicted on Figure 9) within the conservation covenant.
Performance Standard 3b. Enhance the buffer averaging area as part of the total buffer enhancement proposed under Objective 1, following the outlined performance standards for Objective 1.

Objective 4: Provide long-term protection for the buffer enhancement areas.
Performance Standard 4a. Record a conservation covenant with the City of Camas. This performance standard will be met when the Year 1 monitoring report is submitted that includes a copy of the approved and recorded conservation covenant.
Performance Standard 4b. Post permanent boundary signage every 200 feet along the outer edge of the onsite mitigation boundary or as otherwise determined by the Shoreline Administrator. Signage will remain in legible condition; if they are missing or illegible, they will be replaced. This performance standard will be met when signs are documented to be in place and of good condition within the final monitoring report.

Signs are to read:

“Critical Area – Please Retain in a Natural State”

or as otherwise determined by the City of Camas permit conditions.

Table 4. Performance Standards by Monitoring Year.

Habitat Type	Performance Standards by Year			
	Year 1	Year 2	Year 3	Year 5
Wetland Buffer and Oak Woodland Enhancement Areas				
Planted Vegetation Survival	100%	---	---	---
Woody Species Density	---	10-14’ respectively (on center)	10-14’ respectively (on center)	---
Woody Species Aerial Cover	---	---	---	30%
Invasive Plant Species				
Invasive/Non-native plant species	< 10%	< 20%	< 20%	< 20%

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CONCLUSIONS

The above sections outline how the proposed project will meet the CMC Sections 16.53 Wetlands and 16.61 Fish and Wildlife Habitat Conservation Areas. The project will not impose direct impact the onsite wetlands, unnamed seasonal stream or buffer and will also retain all of the Oregon white oak habitat present onsite. The buffer mitigation proposal will ultimately result in an ecological uplift of the onsite wetland buffers and oak habitat while providing extensive connectivity by providing a native vegetated corridor connecting all critical area habitats over degraded areas that have been historically fragmented the habitat connectivity. With issuance of the approved critical areas permits, the proposed buffer mitigation activities will be implemented, and a conservation covenant will be recorded to protect the onsite critical areas and critical area buffers, under the applicant's ownership, in perpetuity.

DISCLAIMER

This report documents the investigation, best professional judgment, and conclusions of the investigator. It is correct and complete to the best of our knowledge. It should be considered a preliminary mitigation plan and used at your own risk until it has been reviewed and approved in writing by the local agency with jurisdiction over the site. AES personnel base the above listed conclusions on standard scientific methodology and best professional judgment.

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REFERENCES

City of Camas Municipal Code. 2008 (Amended). Section 16.53 Wetlands.

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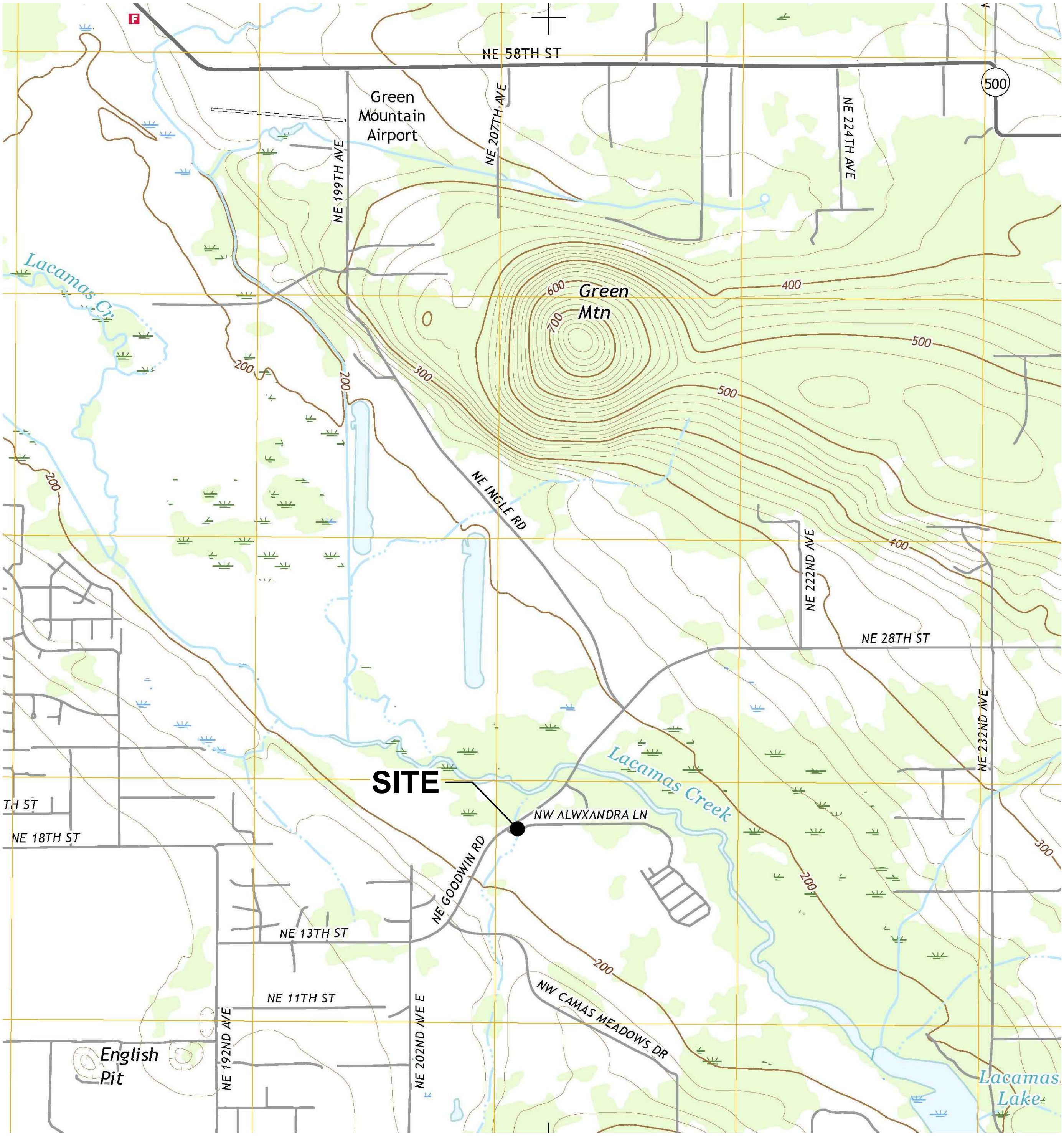

NOTE(S):

USGS, LACAMAS CREEK QUADRANGLE
WASHINGTON-CLARK CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

AshECO
SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

VICINITY MAP

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 1
DATE: 4-15-25

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Exhibit 21 SUB25-1004

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Ash ECO
SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

AERIAL PHOTO & TOPO MAP

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 2
DATE: 4-15-25

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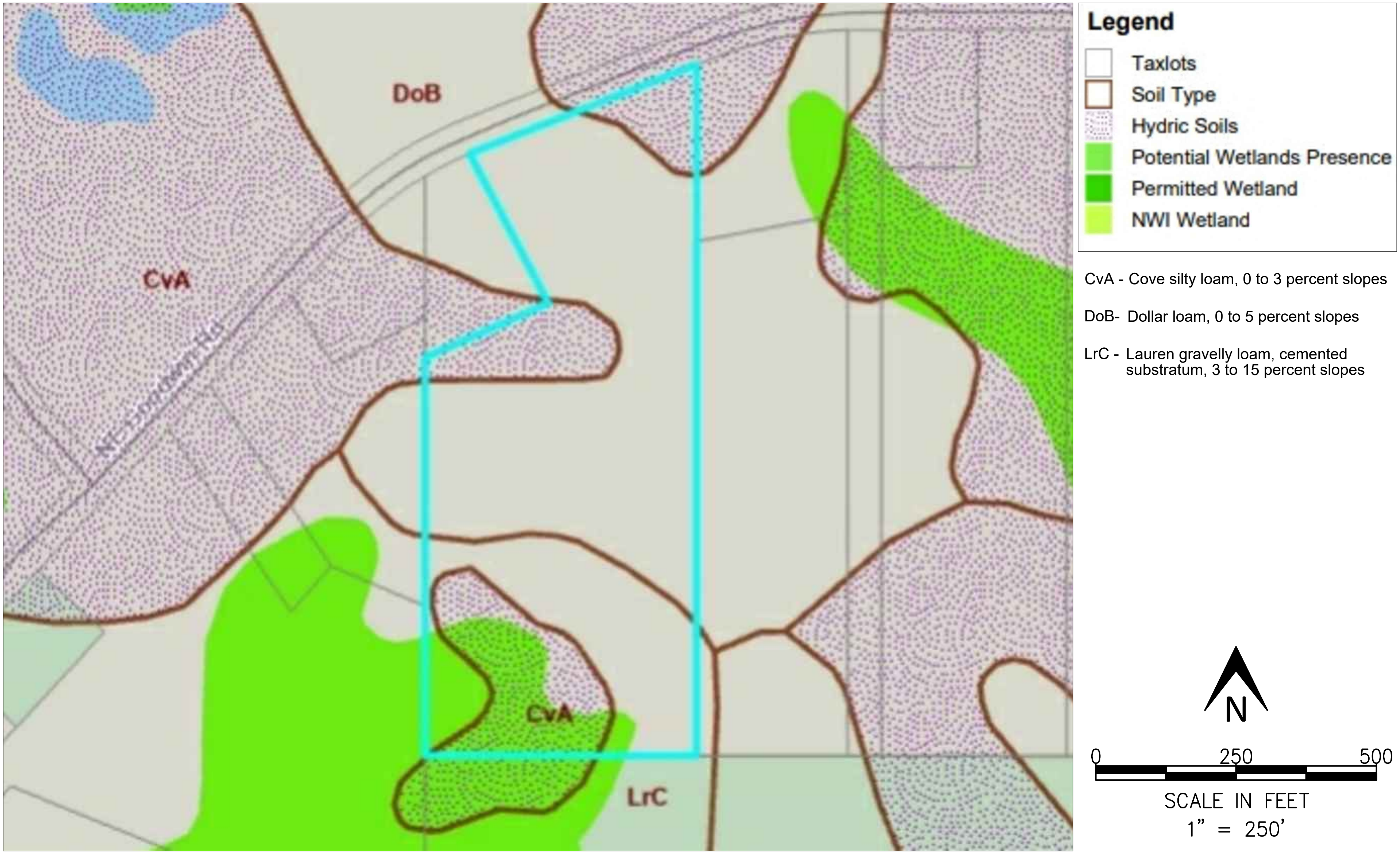

CvA - Cove silty loam, 0 to 3 percent slopes

DoB- Dollar loam, 0 to 5 percent slopes

LrC - Lauren gravelly loam, cemented substratum, 3 to 15 percent slopes

AshECO
SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

SOIL SURVEY &
NATIONAL WETLANDS INVENTORY MAP
APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 3
DATE: 4-15-25

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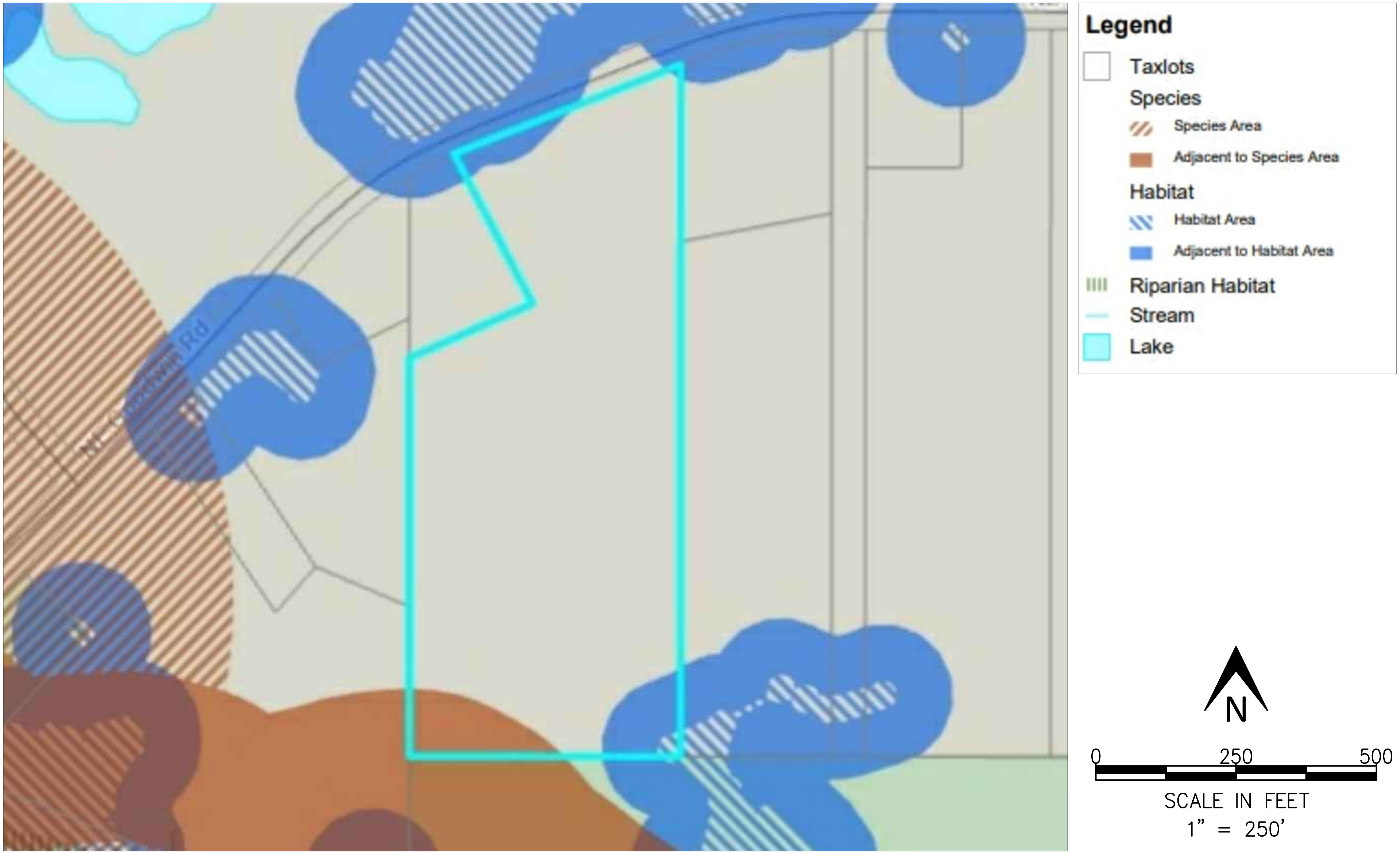
Exhibit 21 SUB25-1004



AshECO
SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

RIPARIAN HABITAT & SPECIES MAP

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 4
DATE: 4-15-25

I:\Autocad Files\AshECO Autocad\PLH Goodwin Road\Goodwin_BM-041425.dwg

Exhibit 21 SUB25-1004

AshECO SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

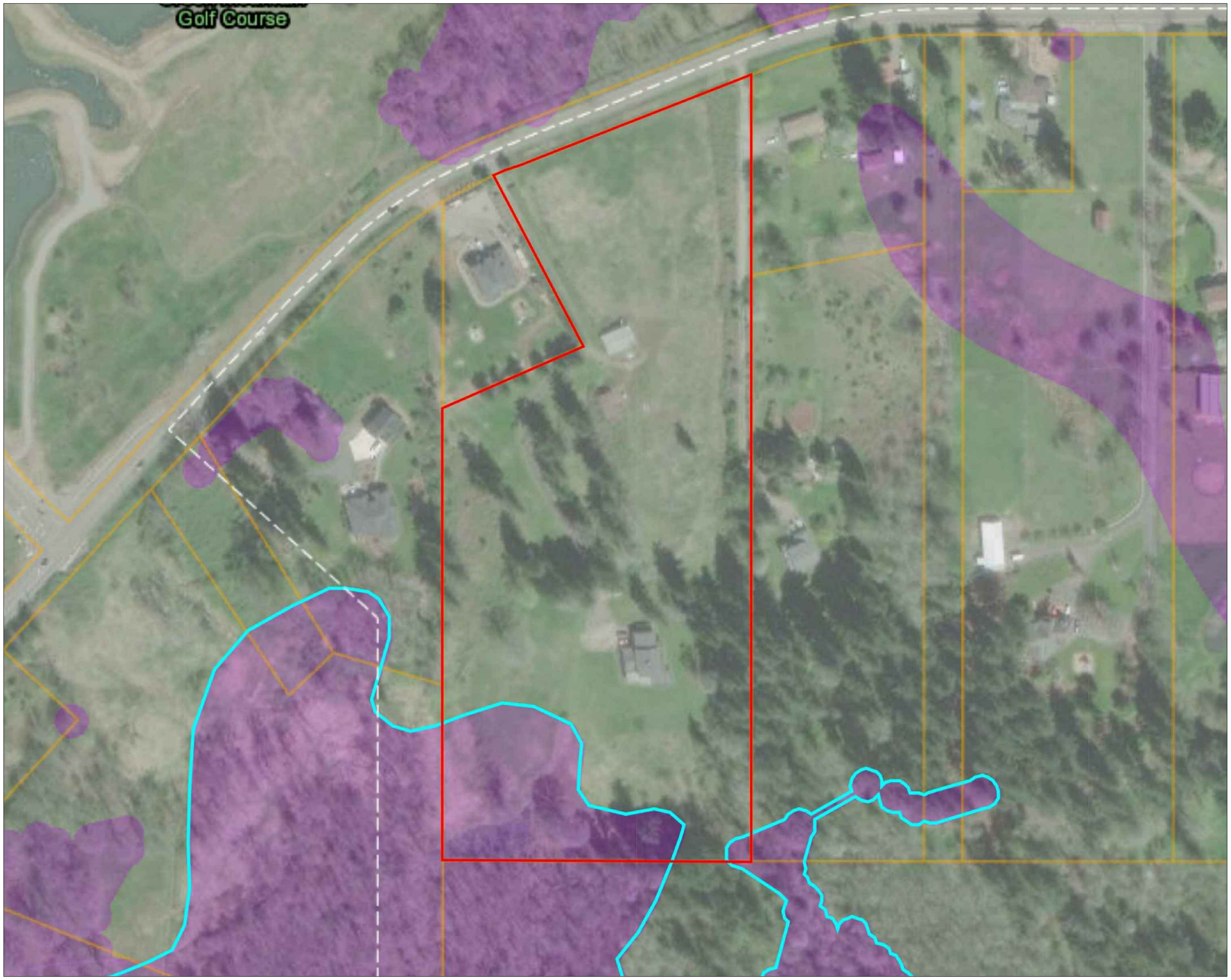
SHORELINES MAP

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 5
DATE: 4-15-25

I:\Autocad Files\AshECO Autocad\PLH Goodwin Road\Goodwin_BM-041425.dwg

Exhibit 21 SUB25-1004



Legend

Parcels

Parcels ☐

PHS on the Web

PHS Public Points ●

PHS Public Lines —

PHS Public Polygon Outlines

☐ AS MAPPED

☐ Masked

PHS Public Polygons

▨ AS MAPPED

▨ SECTION

▨ QTR-TWP

▨ TOWNSHIP

N

0 250 500

SCALE IN FEET
1" = 250'

AshECO
SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

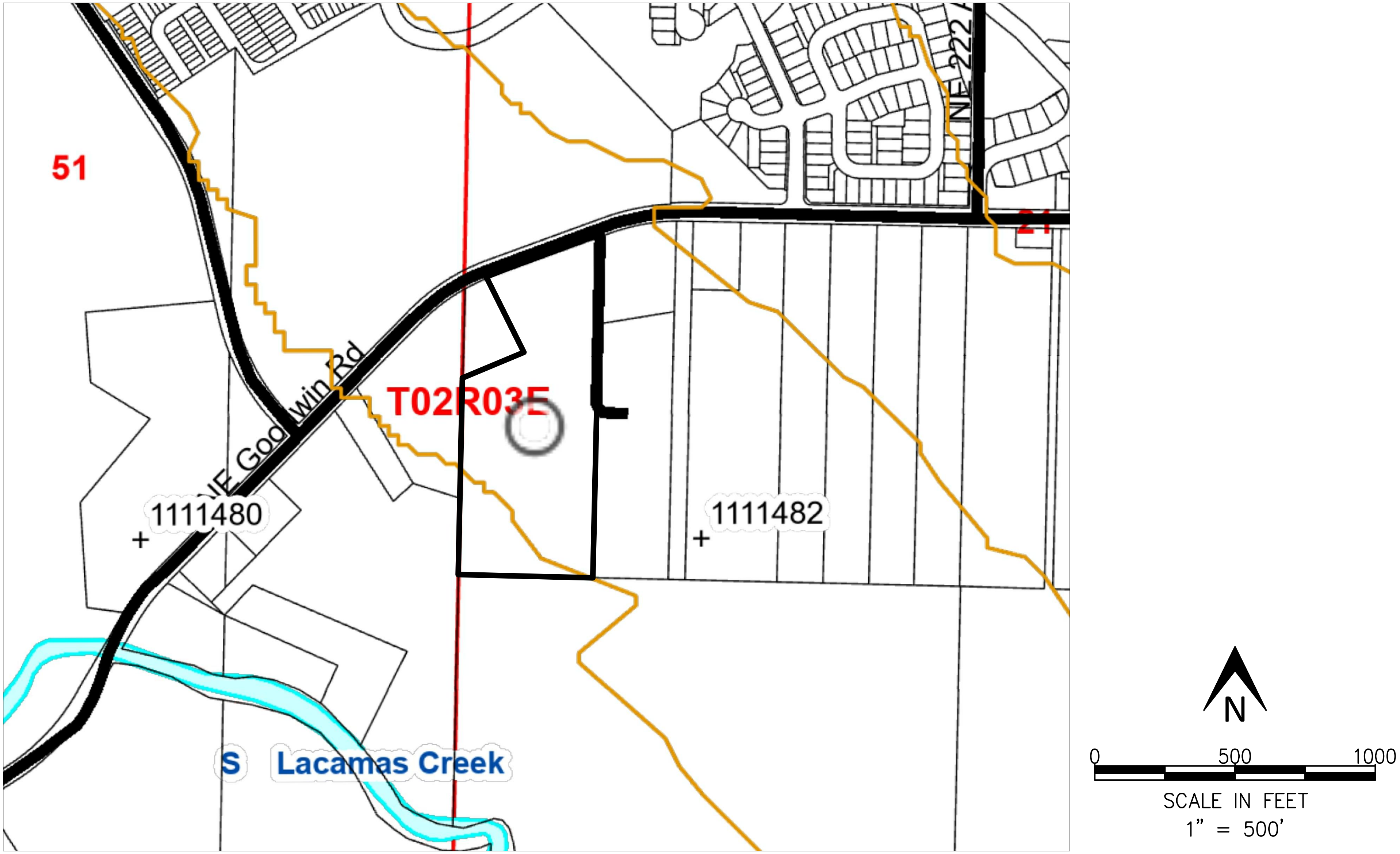
PRIORITY HABITAT & SPECIES MAP

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 6
DATE: 4-15-25

I:\Autocad Files\AshECO Autocad\PLH Goodwin Road\Goodwin_BM-041425.dwg

Exhibit 21 SUB25-1004



AshECO SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

FPARS MAP

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 7
DATE: 4-15-25

I:\Autocad Files\AshECO Autocad\PLH Goodwin Road\Goodwin_BM-041425.dwg

Exhibit 21 SUB25-1004

Note:
The aerial photo does not exactly match the professional survey linework provided for the Oregon White Oak trees or parcel boundary.

AshECO SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

EXISTING CONDITIONS

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 8
DATE: 4-30-25

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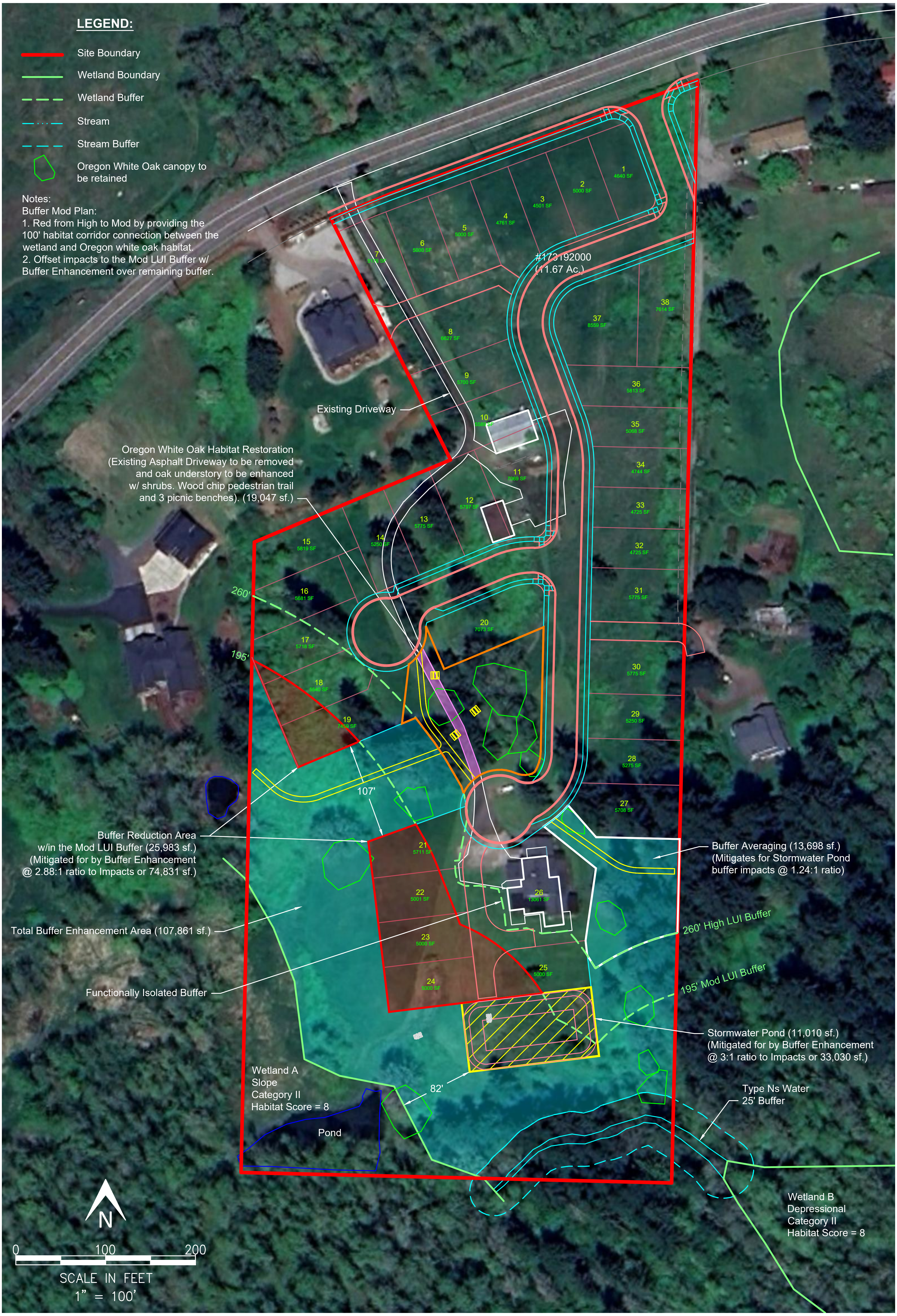
Exhibit 21 SUB25-1004



Notes:
Buffer Mod Plan:
1. Red from High to Mod by providing the 100' habitat corridor connection between the wetland and Oregon white oak habitat.
2. Offset impacts to the Mod LUI Buffer w/ Buffer Enhancement over remaining buffer.

I:\Autocad Files\AshECO Autocad\PLH Goodwin Road\Goodwin_BM-050625.dwg

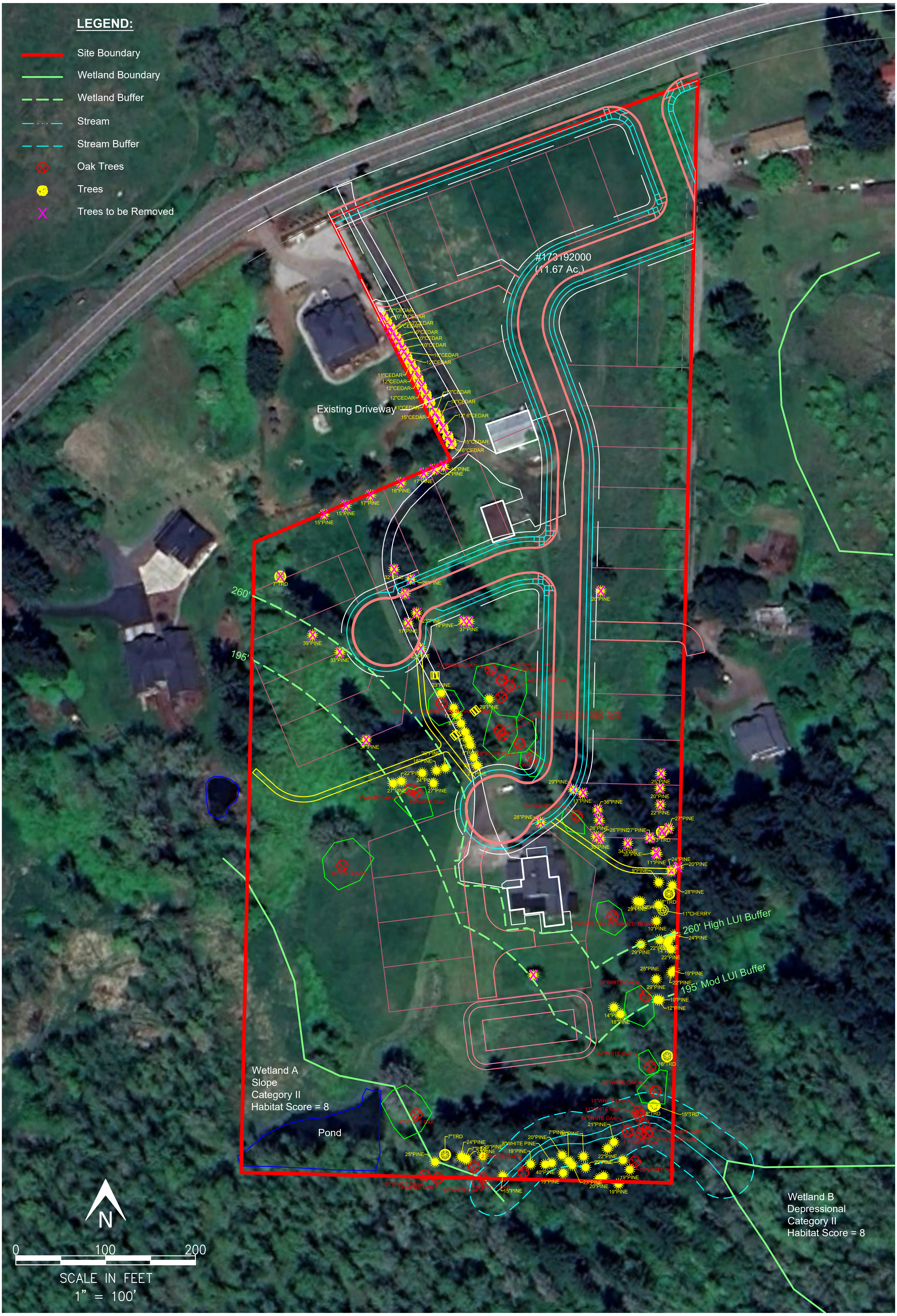
AshECO SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

PROPOSED SITE PLAN

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 9
DATE: 5-6-25



AshECO SOLUTIONS, LLC

PURPOSE: XX
Line 1
Line 2
DATUM: NAVD 88
ADJACENT PROPERTY OWNERS:
Adj 1
Adj 2

TREE PLAN

APPLICANT: Pacific Lifestyle Homes
PROJECT NAME: PLH Goodwin Rd.
PARCEL #: 173192000
SITE LOCATION ADDRESS:
2625 NE Goodwin Rd.

PROPOSED: XX
Add 2
IN: Camas
NEAR: XX
COUNTY: Clark **STATE:** WA
FIGURE: 10
DATE: 5-6-25

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Exhibit 21 SUB25-1004

Appendix A

Site Photos

Exhibit 21 SUB25-1004

Reserve at Green Mountain - Site Photos

Photo 1.

View of the existing residence located within the southern portion of the proposed development. This southern open area of the parcel generally degraded from landscape mowing activities as it is dominated by grass lawn.

Photo 2.

View of the general area, north of the existing residence, within the proposed development.

Photo 3.

View into a portion of Wetland A dominated by invasive reed canarygrass. The eastern extent of this wetland along the western parcel boundary of the subject parcel is dominated by Himalayan blackberry.

Reserve at Green Mountain - Site Photos

Photo 4.
View east over the man-made pond excavated within Wetland A, located in the southwest corner of the subject parcel. An individual Oregon white oak tree present directly northeast of the pond is visible in upper/central portion of this photo.

Photo 5.
View into Oregon white oak located with central area of the site. This oak habitat will be retained and the understory enhanced with native shrubs.

Photo 6.
View of the individual Oregon white oak located along the western property boundary. Wetland A is located directly west from this oak tree, at left of photo view. This oak will be retained and a habitat corridor connection will be created by implementing the buffer mitigation plan. This includes retention of this oak and other adjacent oaks and the enhancement of the surrounding habitat corridor to provide a vegetated wildlife corridor where none has historically been present due to the existing maintained lawn and driveway.

Exhibit 21 SUB25-1004

Reserve at Green Mountain - Site Photos

Photo 7.
View south down the existing paved residential driveway that has bisected the Oregon white oak habitat located within the central portion of the parcel. The driveway will be removed and the understory habitat restored with native plantings to provide a vegetated corridor connecting the mature oak habitat onsite as well as connect it to the nearby wetland habitat. corridor to provide a vegetated wildlife corridor where none has historically been present due to the existing maintained lawn and driveway.

Photo 8.
View west down the Type Ns stream that conveys seasonal hydrology down slope from Wetland B in the east to Wetland A in the west.

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Photo 9.
View into the central ponded portion of Wetland B located just off site to the east.

Appendix B

Wetland Determination Datasheets

Exhibit 21 SUB25-1004

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: The Reserve at Green Mt - Wetland A City/County: Camas/Clark Sampling Date: ______
Applicant/Owner: Pacfic Lifestyle Homes State: WA Sampling Point: TP-1
Investigator(s): Andrea Aberle Section, Township, Range: SW 1/4, S21, T2N, R3E
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex Slope (%): 0-3
Subregion (LRR): LRRA Lat: 45.639463° Long: -122.451880° Datum: ______
Soil Map Unit Name: Cove silty clay loam, 0-3% slopes NWI classification: PFOA - South of subject site
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ______
Hydric Soil Present? Yes ______ No ✓
Wetland Hydrology Present? Yes ______ No ✓

Is the Sampled Area within a Wetland? **Yes** ______ **No** ✓

Remarks:
Test plot is located in upland. Only one of 3-wetland indicators is present. Dominate vegetation is faculative.
No hydric soils or hydrology indicators occur within plot.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover			
Woody Vine Stratum (Plot size: 30ft diameter)			
1. Rubus armeniacus	100%	Y	FAC
2.			
= Total Cover	100%		

% Bare Ground in Herb Stratum ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
✓ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ______

Remarks:

Exhibit 21 SUB25-1004

SOIL

Sampling Point: TP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-16"	10YR 4/2	100%						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Exhibit 21 SUB25-1004

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: The Reserve at Green Mt - Wetland A City/County: Camas/Clark Sampling Date: ______

Applicant/Owner: Pacfic Lifestyle Homes State: WA Sampling Point: TP-2

Investigator(s): Andrea Aberle Section, Township, Range: SW 1/4, S21, T2N, R3E

Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex Slope (%): 0-3%

Subregion (LRR): LRRA Lat: 45.639463° Long: -122.451880° Datum: ______

Soil Map Unit Name: Lauren gravelly loam, cemented substratum, 3% to 15% slopes NWI classification: PFOA - South of subject site

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ✓ No ______

Hydric Soil Present? Yes ✓ No ______

Wetland Hydrology Present? Yes ✓ No ______

Is the Sampled Area within a Wetland? Yes ✓ No ______

Remarks:

Test plot is located in upland. Only one of 3-wetland indicators is present. Dominate vegetation is faculative.
No hydric soils or hydrology indicators occur within plot.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: 30ft diameter)			
1. Salix sitchensis	40%	Y	FACW
2.			
3.			
4.			
5.			
	40% = Total Cover		
Herb Stratum (Plot size: 5ft diameter)			
1. Phalaris arundinacea	90%	Y	FACW
2. Juncus effusus	10%	N	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100% = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ______

Remarks:

Exhibit 21 SUB25-1004

SOIL

Sampling Point: TP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-16"	10YR 4/2	98%	5YR 3/2	2%	C	M	clay loam	
							clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ **No** ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches): ______

Water Table Present? Yes ✓ No ______ Depth (inches): 2" BGS

Saturation Present? (includes capillary fringe) Yes ______ No ✓ Depth (inches): ______

Wetland Hydrology Present? Yes ✓ **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Exhibit 21 SUB25-1004

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: The Reserve at Green Mt - Wetland A City/County: Camas/Clark Sampling Date: ______
Applicant/Owner: Pacfic Lifestyle Homes State: WA Sampling Point: TP-3
Investigator(s): Andrea Aberle Section, Township, Range: SW 1/4, S21, T2N, R3E
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex Slope (%): 0-3
Subregion (LRR): LRRA Lat: 45.639463° Long: -122.451880° Datum: ______
Soil Map Unit Name: Cove silty clay loam, 0-3% slopes NWI classification: PFOA - South of subject site
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are “Normal Circumstances” present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ______ No ✓
Hydric Soil Present? Yes ______ No ✓
Wetland Hydrology Present? Yes ______ No ✓

Is the Sampled Area within a Wetland? **Yes** ______ **No** ✓

Remarks:
Test plot is located in upland. Only one of 3-wetland indicators is present. Dominate vegetation is faculative.
No hydric soils or hydrology indicators occur within plot.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: 30ft diameter)			
1. Pseudotsuga menziesii	60%	Y	FACU
2. Tsuga heterophylla	20%	Y	FACU
3.			
4.			
	80%	= Total Cover	
Sapling/Shrub Stratum (Plot size: 30ft diameter)			
1. Symphoricarpos albus	20%	Y	FACU
2.			
3.			
4.			
5.			
	20%	= Total Cover	
Herb Stratum (Plot size: 5ft diameter)			
1. Polystichum munitum	20%	Y	FACU
2. Tellima grandiflora	20%	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40%	= Total Cover	
Woody Vine Stratum (Plot size: 30ft diameter)			
1. Rubus armeniacus	30%	Y	FAC
2.			
	30%	= Total Cover	

% Bare Ground in Herb Stratum ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)
Total Number of Dominant Species Across All Strata: 6 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ______ **No** ✓

Remarks:

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SOIL

Sampling Point: TP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks
0-16"	10YR 4/1	100%					loamy clay	mixed matrix
	10YR 4/2	100%					loamy clay	mixed matrix

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______
Depth (inches): ______

Hydric Soil Present? Yes ______ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches): ______
Water Table Present? Yes ______ No ✓ Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes ______ No ✓ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: The Reserve at Green Mt - Wetland A City/County: Camas/Clark Sampling Date: ______
Applicant/Owner: Pacfic Lifestyle Homes State: WA Sampling Point: TP-4
Investigator(s): Andrea Aberle Section, Township, Range: SW 1/4, S21, T2N, R3E
Landform (hillslope, terrace, etc.): terrace Local relief (concave, convex, none): convex Slope (%): 0-3%
Subregion (LRR): LRRA Lat: 45.639463° Long: -122.451880° Datum: ______
Soil Map Unit Name: Lauren gravelly loam, cemented substratum, 3% to 15% slopes NWI classification: PFOA - South of subject site
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______
Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ______
Hydric Soil Present?	Yes ✓	No ______
Wetland Hydrology Present?	Yes ✓	No ______

Is the Sampled Area within a Wetland? **Yes** ✓ **No** ______

Remarks:
Test plot is located in upland. Only one of 3-wetland indicators is present. Dominate vegetation is faculative.
No hydric soils or hydrology indicators occur within plot.

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: 30ft diameter)			
1. Symphoricarpos albus	40%	Y	FACU
2. Rosa nutkana	20%	Y	FACU
3.			
4.			
5.			
= Total Cover	40%		
Herb Stratum (Plot size: 5ft diameter)			
1. Phalaris arundinacea	40%	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	40%		
Woody Vine Stratum (Plot size: 30ft diameter)			
1. Rubus armeniacus	20%	Y	FAC
2.			
= Total Cover	20%		

% Bare Ground in Herb Stratum ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	______	x 1 =	______
FACW species	______	x 2 =	______
FAC species	______	x 3 =	______
FACU species	______	x 4 =	______
UPL species	______	x 5 =	______
Column Totals:	______ (A)		______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ______

Remarks:

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SOIL

Sampling Point: TP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-16"	10YR 4/2	98%	5YR 3/2	2%	C	M	clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ✓ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ **No** ______

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ✓ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ✓ No ______ Depth (inches): 0.5-1"

Water Table Present? Yes ✓ No ______ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ✓ No ______ Depth (inches): ______

Wetland Hydrology Present? Yes ✓ **No** ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

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Appendix C

Wetland Rating Form & Figures

Exhibit 21 SUB25-1004

Wetland name or number Wetland A

RATING SUMMARY – Western Washington

Name of wetland (or ID #): The Reserve at Green Mt - Wetland A Date of site visit: 3/25

Rated by Andrea Aberle Trained by Ecology? ✓Yes ___No Date of training 10/16

HGM Class used for rating slope Wetland has multiple HGM classes? ___Y ✓N

NOTE: **Form is not complete without the required figures** (figures can be combined).
Source of base aerial photo/map Google Earth

OVERALL WETLAND CATEGORY II (based on functions ✓ or special characteristics__)

1. Category of wetland based on FUNCTIONS

_______**Category I** – Total score = 23 - 27
✓ **Category II** – Total score = 20 - 22
_______**Category III** – Total score = 16 - 19
_______**Category IV** – Total score = 9 - 15

FUNCTION	**Improving Water Quality**			**Hydrologic**			**Habitat**			
Circle the appropriate ratings										
Site Potential	H	M	[✓ L]	H	[✓ M]	L	[✓ H]	M	L	
Landscape Potential	H	[✓ M]	L	H	[✓ M]	L	H	[✓ M]	L	
Value	[✓ H]	M	L	H	[✓ M]	L	[✓ H]	M	L	**TOTAL**
Score Based on Ratings	6			6			8			20

Score for each function based on three ratings
(order of ratings is not important)

9 = H, H, H
8 = H, H, M
7 = H, H, L
7 = H, M, M
6 = H, M, L
6 = M, M, M
5 = H, L, L
5 = M, M, L
4 = M, L, L
3 = L, L, L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	**CATEGORY**
Estuarine	**I II**
Wetland of High Conservation Value	**I**
Bog	**I**
Mature Forest	**I**
Old Growth Forest	**I**
Coastal Lagoon	**I II**
Interdunal	**I II III IV**
None of the above	

Wetland name or number Wetland A

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	Figure 1
Hydroperiods	H 1.2	Figure 1
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	Figure 1
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	Figure 1
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	Figure 1
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and total habitat	H 2.1, H 2.2, H 2.3	Figure 2
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	Figure 3
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	Figure 3

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HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

[✓ NO] – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe, it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.

2. The entire wetland unit is flat, and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

[✓ NO] – go to 3 **YES** – The wetland class is **Flats**
If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.

3. Does the entire wetland unit **meet all** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size,
___At least 30% of the open water area is deeper than 6.6 ft (2 m).

[✓ NO] – go to 4 **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
✓ The wetland is on a slope (slope can be very gradual),
✓ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheet flow, or in a swale without distinct banks,
✓ The water leaves the wetland **without being impounded**.

NO – go to 5 [✓ **YES**] **–** The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

Wetland name or number Wetland A

5. Does the entire wetland unit **meet all** of the following criteria?
   ____The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ____The overbank flooding occurs at least once every 2 years.

   NO – go to 6 **YES** – The wetland class is **Riverine**
   NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? This means that any outlet, if present, is higher than the interior of the wetland.

   NO – go to 7 **YES** – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched but has no obvious natural outlet.

   NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

   NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have **more than 2 HGM classes** within a wetland boundary, classify the wetland as Depressional for the rating.

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Wetland name or number Wetland A

SLOPE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: (A 1% slope has a 1 ft vertical change in elevation for every 100 ft of horizontal distance.) Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	2
S 1.2. The soil 2 in. below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed, and plants are higher than 6 in. Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	3
Total for S 1 Add the points in the boxes above	5

Rating of Site Potential If score is: **__12 = H ___6-11 = M ✓0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources adjacent septic systems Yes = 1 No = 0	1
Total for S 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is: **✓1-2 = M ___0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? (At least one aquatic resource in the basin is on the 303(d) list.) Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? (Answer YES if there is a TMDL in development or in effect for the basin in which unit is found.) Yes = 2 No = 0	1
Total for S 3 Add the points in the boxes above	3

Rating of Value If score is: **✓2-4 = H ___1 = M ___0 = L** *Record the rating on the first page*

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Wetland name or number Wetland A

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. Stems of plants should be thick enough (usually > $^1/_8$ in), or dense enough, to remain erect during surface flows. Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	1

Rating of Site Potential If score is: ✓**1 = M** ___**0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	1

Rating of Landscape Potential If score is: ✓**1 = M** ___**0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately downgradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther downgradient points = 1 No flooding problems anywhere downstream points = 0	1
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 Add the points in the boxes above	1

Rating of Value If score is: ___**2-4 = H** ✓**1 = M** ___**0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

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Wetland name or number Wetland A

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: Indicators are Cowardin classes and strata within the Forested class. Check the Cowardin plant classes in the wetland. Up to 10 patches may be combined for each class to meet the threshold of ¼ ac if the unit is at least 2.5 ac, or more than 10% of the unit if it is smaller than 2.5 ac.

____Aquatic bed — 4 structures or more: points = 4
____Emergent — 3 structures: points = 2
✓ Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1
✓ Forested (areas where trees have > 30% cover) — 1 structure: points = 0

If the unit has a Forested class, check if:

✓ The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/groundcover) that each cover 20% within the Forested polygon

2

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland if the unit is < 2.5 ac, or ¼ ac if the unit is at least 2.5 ac to count (see text for descriptions of hydroperiods).

✓ Permanently flooded or inundated — 4 or more types present: points = 3
✓ Seasonally flooded or inundated — 3 types present: points = 2
____Occasionally flooded or inundated — 2 types present: points = 1
✓ Saturated only — 1 type present: points = 0
✓ Permanently flowing stream or river in, or adjacent to, the wetland
____Intermittently or seasonally flowing stream in, or adjacent to, the wetland
____**Lake Fringe wetland** — **2 points**
____**Freshwater tidal wetland** — **2 points**

3

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. **Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canada thistle**

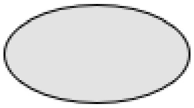
If you counted: > 19 species — points = 2
5 - 19 species — points = 1
< 5 species — points = 0

2

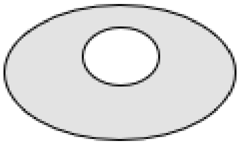
H 1.4. Interspersion of habitats

3

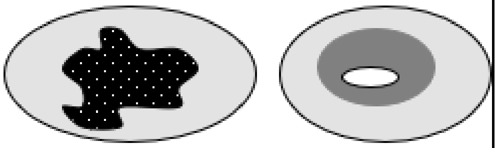
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. If you have four or more plant classes or three classes and open water, the rating is always high.



None = 0 points

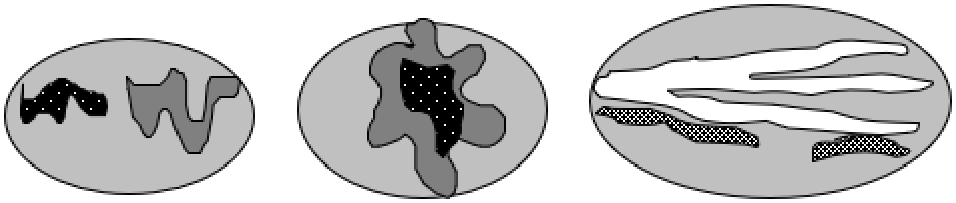


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **High** = 3 points



Wetland name or number Wetland A

H 1.5. Special habitat features:

Check the habitat features that are present in the wetland. The number of checks is the number of points.

✓ Large, downed, woody debris within the wetland (> 4 in. diameter and 6 ft long).

✓ Standing snags (dbh > 4 in.) within the wetland

✓ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extend at least 3.3 ft (1 m) over open water or a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)

✓ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present (cut shrubs or trees that have not yet weathered where wood is exposed)

✓ At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (structures for egg-laying by amphibians)

____Invasive plants cover less than 25% of the wetland area in every stratum of plants (see H 1.1 above for the list of strata and H 1.5 in the manual for the list of aggressive plant species)

5

Total for H 1 Add the points in the boxes above 15

Rating of Site Potential If score is: ✓**15-18 = H** ____**7-14 = M** ____**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?

H 2.1. Accessible habitat (include only habitat polygons accessible from the wetland.

Calculate: % relatively undisturbed habitat ~~16~~% + [(~~18%~~moderate and low intensity land uses)/2]=~~17%~~

Total accessible habitat is:

7% Accessible + (31/2) 15.5% = 22.5%

> $^{1}/_{3}$ (33.3%) of 1 km Polygon	points = 3
20-33% of 1 km Polygon	points = 2
10-19% of 1 km Polygon	points = 1
< 10% of 1 km Polygon	points = 0

2

H 2.2. Total habitat in 1 km Polygon around the wetland.

Calculate: % relatively undisturbed habitat ~~26~~%+ [(~~18%~~ moderate and low intensity land uses)/2] =~~22%~~

20% Undist + (15.5%) = 35.5 (4 patches)

Total habitat > 50% of Polygon	points = 3
Total habitat 10-50% and in 1-3 patches	points = 2
Total habitat 10-50% and > 3 patches	points = 1
Total habitat < 10% of 1 km Polygon	points = 0

1

H 2.3. Land use intensity in 1 km Polygon:

High LUI = 42

> 50% of 1 km Polygon is high intensity land use	points = (- 2)
≤ 50% of 1 km Polygon is high intensity	points = 0

0

Total for H 2 Add the points in the boxes above 31

Rating of Landscape Potential If score is: ____**4-6 = H** ✓**1-3 = M** ____**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?

H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.*

2

Site meets ANY of the following criteria: points = 2

- ✓ It has 3 or more Priority Habitats within 100 m (see next page)
- — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)
- — It is mapped as a location for an individual WDFW Priority Species
- — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources data
- — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan

Site has 1 or 2 Priority Habitats (listed on next page) within 100 m points = 1

Site does not meet any of the criteria above points = 0

Rating of Value If score is: ✓**2 = H** ____**1 = M** ____**0 = L** *Record the rating on the first page*

Exhibit 21 SUB25-1004

Wetland name or number Wetland A

WDFW Priority Habitats

See complete descriptions of Priority Habitats listed by WDFW, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008 (current year, as revised). Priority Habitat and Species List.[133] This list was updated for consistency with guidance from WDFW.

This question is independent of the land use between the wetland unit and the Priority Habitat. All vegetated wetlands are by definition a Priority Habitat but are not included in this list because they are addressed by this rating system.

Count how many of the following Priority Habitats are within 330 ft (100 m) of the wetland unit:

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife. This habitat automatically counts if mapped on the PHS online map within 100m of the wetland. If not mapped, a determination can be made in the field.

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Fresh Deepwater:** Lands permanently flooded with freshwater, including environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live. Substrate does not support emergent vegetation. Do not select if Instream habitat is also present, or if the entire Deepwater feature is included in the wetland unit being rated (such as a pond with a vegetated fringe).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

✓ **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources. Do not select if Fresh Deepwater habitat is also present.

— **Nearshore:** Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in. (81 cm) diameter at breast height (dbh) or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in. (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

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[133] http://wdfw.wa.gov/publications/00165/wdfw00165.pdf

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Wetland name or number Wetland A

✓ **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important. For single oaks or oak stands <0.4 ha in urban areas, WDFW's Management Recommendations for Oregon White Oak[134] provides more detail for determining if they are Priority Habitats

✓ **Riparian:** The area adjacent to freshwater aquatic systems with flowing or standing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

✓ **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in. (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in. (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie.

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[134] https://wdfw.wa.gov/publications/00030/wdfw00030.pdf

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Wetland name or number B

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland B Date of site visit: 3/25

Rated by Andrea Aberle Trained by Ecology? ✓Yes ___No Date of training 10/06

HGM Class used for rating Depressional Wetland has multiple HGM classes?___Y X N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.

Source of base aerial photo/map Google Earth

OVERALL WETLAND CATEGORY II (based on functions ✓ or special characteristics___)

1. Category of wetland based on FUNCTIONS

_______**Category I** – Total score = 23 - 27

X **Category II** – Total score = 20 - 22

_______**Category III** – Total score = 16 - 19

_______**Category IV** – Total score = 9 - 15

FUNCTION	**Improving Water Quality**	**Hydrologic**	**Habitat**	
			Circle the appropriate ratings	
Site Potential	H [✓ M] L	H [✓ M] L	[✓ H] M L	
Landscape Potential	H [✓ M] L	H [✓ M] L	H [✓ M] L	
Value	[✓ H] M L	H [✓ M] L	[✓ H] M L	**TOTAL**
Score Based on Ratings	7	6	8	21

Score for each function based on three ratings
(order of ratings is not important)

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	**CATEGORY**
Estuarine	I II
Wetland of High Conservation Value	I
Bog	I
Mature Forest	I
Old Growth Forest	I
Coastal Lagoon	I II
Interdunal	I II III IV
None of the above	✓

Wetland name or number B

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

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Wetland name or number B

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

NO – go to 2 **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
If your wetland can be classified as a Freshwater Tidal Fringe use the forms for ***Riverine*** *wetlands. If it is Saltwater Tidal Fringe it is an* ***Estuarine*** *wetland and is not scored. This method* ***cannot*** *be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

NO – go to 3 **YES** – The wetland class is **Flats**
If your wetland can be classified as a Flats wetland, use the form for ***Depressional*** *wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
___At least 30% of the open water area is deeper than 6.6 ft (2 m).

NO – go to 4 **YES** – The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?
✓ The wetland is on a slope (*slope can be very gradual*),
✓ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
✗ The water leaves the wetland **without being impounded**. (Dependant on beaver activity)

NO – go to 5 [✓ **YES**] – The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?
___The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
___The overbank flooding occurs at least once every 2 years.

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Wetland name or number B

NO – go to 6 **YES** – The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

NO – go to 7 [✓ **YES**] – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

NO – go to 8 **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
[✓ Slope + Depressional]	[✓ Depressional]
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

If you are still unable to determine which of the above criteria apply to your wetland, or if you have ***more than 2 HGM classes*** *within a wetland boundary, classify the wetland as Depressional for the rating.*

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Wetland name or number B

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	2
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic (*use NRCS definitions*). Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^{1}/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^{1}/_{10}$ of area points = 0	3
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	4
Total for D 1 Add the points in the boxes above	9

Rating of Site Potential If score is: ___**12-16 = H** [✓ **6-11 = M**] ___**0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	1
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	1
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source________________ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	2

Rating of Landscape Potential If score is: ___**3 or 4 = H** [✓ **1 or 2 = M**] ___**0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	1
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	1
Total for D 3 Add the points in the boxes above	3

Rating of Value If score is: [✓ **2-4 = H**] ___**1 = M** ___**0 = L** *Record the rating on the first page*

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Wetland name or number B____

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	2
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	3
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire wetland is in the Flats class points = 5	3
Total for D 4 Add the points in the boxes above	8

Rating of Site Potential If score is:___**12-16 = H** ✓**6-11 = M** ___**0-5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	1
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	0
Total for D 5 Add the points in the boxes above	1

Rating of Landscape Potential If score is:___**3 = H** ✓**1 or 2 = M** ___**0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____________ points = 0 There are no problems with flooding downstream of the wetland. points = 0	1
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	1

Rating of Value If score is:___**2-4 = H** ✓**1 = M** ___**0 = L** *Record the rating on the first page*

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Wetland name or number B

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

4

X Aquatic bed
X Emergent
X Scrub-shrub (areas where shrubs have > 30% cover)
X Forested (areas where trees have > 30% cover)

4 structures or more: points = 4
3 structures: points = 2
2 structures: points = 1
1 structure: points = 0

If the unit has a Forested class, check if:

____The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

H 1.2. Hydroperiods

2

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated
X Seasonally flooded or inundated
____Occasionally flooded or inundated
X Saturated only
____Permanently flowing stream or river in, or adjacent to, the wetland
X Seasonally flowing stream in, or adjacent to, the wetland
____**Lake Fringe wetland** **2 points**
____**Freshwater tidal wetland** **2 points**

4 or more types present: points = 3
3 types present: points = 2
2 types present: points = 1
1 type present: points = 0

H 1.3. Richness of plant species

2

Count the number of plant species in the wetland that cover at least 10 ft^2.

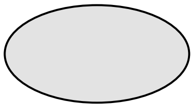
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species points = 2
5 - 19 species points = 1
< 5 species points = 0

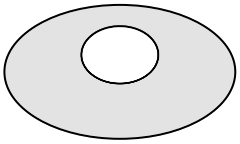
H 1.4. Interspersion of habitats

2

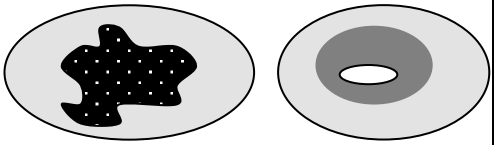
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points



Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3points

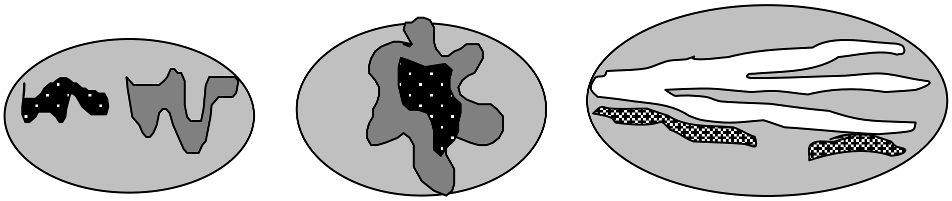


Exhibit 21 SUB25-1004

Wetland name or number B

H 1.5. Special habitat features: 5

Check the habitat features that are present in the wetland. *The number of checks is the number of points.*

X Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long).

X Standing snags (dbh > 4 in) within the wetland

X Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)

____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)*

X At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)*

X Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)

Total for H 1 — Add the points in the boxes above: 15

Rating of Site Potential If score is: **[✓ 15-18 = H] ___7-14 = M ___0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?

H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). 2

Calculate: % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** _______%

If total accessible habitat is:

7% Accessible + (31/2) 15.5% = 22.5%

> $^1/_3$ (33.3%) of 1 km Polygon — points = 3

20-33% of 1 km Polygon — points = 2

10-19% of 1 km Polygon — points = 1

< 10% of 1 km Polygon — points = 0

H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. 1

Calculate: % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** _______%

Undisturbed habitat > 50% of Polygon — points = 3

Undisturbed habitat 10-50% and in 1-3 patches — points = 2

20% Undist + (15.5%) = 35.5 (4 patches)

Undisturbed habitat 10-50% and > 3 patches — points = 1

Undisturbed habitat < 10% of 1 km Polygon — points = 0

H 2.3. Land use intensity in 1 km Polygon: If 0

High = 42%

> 50% of 1 km Polygon is high intensity land use — points = (- 2)

≤ 50% of 1 km Polygon is high intensity — points = 0

Total for H 2 — Add the points in the boxes above: 3

Rating of Landscape Potential If score is: **___4-6 = H [✓ 1-3 = M] ___< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?

H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* 2

Site meets ANY of the following criteria: — points = 2

X It has 3 or more priority habitats within 100 m (see next page)

— It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists)

— It is mapped as a location for an individual WDFW priority species

— It is a Wetland of High Conservation Value as determined by the Department of Natural Resources

— It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan

Site has 1 or 2 priority habitats (listed on next page) within 100 m — points = 1

Site does not meet any of the criteria above — points = 0

Rating of Value If score is: **[✓ 2 = H] ___1 = M ___0 = L** *Record the rating on the first page*

Exhibit 21 SUB25-1004

Wetland name or number B

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

✓ **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

✓ **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

✓ **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Exhibit 21 SUB25-1004

Wetland name or number _____

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes **–**Go to **SC 1.1** No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**Cat. I**
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? Yes **–** Go to **SC 2.2** No **–** Go to **SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? Yes **= Category I** No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf Yes **– Contact WNHP/WDNR and go to SC 2.4** No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? Yes **= Category I** No **= Not a WHCV**	**Cat. I**
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? Yes – Go to **SC 3.3** No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? Yes – Go to **SC 3.3** No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? Yes = **Is a Category I bog** No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? Yes = **Is a Category I bog** No **= Is not a bog**	**Cat. I**

Exhibit 21 SUB25-1004

Wetland name or number _____

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** No **= Not a forested wetland for this section**	**Cat. I**
SC 5.0. Wetlands in Coastal Lagoons Does the wetland meet all of the following criteria of a wetland in a coastal lagoon? — The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks — The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)* Yes – Go to **SC 5.1** No = **Not a wetland in a coastal lagoon** SC 5.1. Does the wetland meet all of the following three conditions? — The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100). — At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. — The wetland is larger than $^{1}/_{10}$ ac (4350 ft^{2}) Yes = **Category I** No = **Category II**	**Cat. I** **Cat. II**
SC 6.0. Interdunal Wetlands Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.*** In practical terms that means the following geographic areas: — Long Beach Peninsula: Lands west of SR 103 — Grayland-Westport: Lands west of SR 105 — Ocean Shores-Copalis: Lands west of SR 115 and SR 109 Yes – Go to **SC 6.1** No = **not an interdunal wetland for rating** SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? Yes = **Category I** No – Go to **SC 6.2** SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger? Yes = **Category II** No – Go to **SC 6.3** SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac? Yes = **Category III** No = **Category IV**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	

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Exhibit 21 SUB25-1004

The Reserve

Wetland Unit Map

Wetland A
Slope Wetland Unit
(Hydrology collects in small depressions throughout, seasonal sheet flow south over unit to Lacamas Creek, overbank flooding doesn't appear to extend over this full area).

Cowardin Plant Classes:
Forested
Scrub/Shrub
Dense Ridge Plant Cover

Hydroperiods:
Permanently flooded,
Seasonally flooded,
aturated Adjacent to Permanently Flowing Stream (Lacamas Creek)

Wetland B
Depressional Wetland Unit
(Ponding throughout, unidirectional flow southwest via stream channel, sits higher in elevation that the wetland to west).

Cowardin Plant Classes:
Aquatic
Emergent
Forested
Scrub/Shrub

Hydroperiods:
Seasonally flooded,
Saturated,
Adjacent to Seasonally Flowing Stream

Legend

The Reserve

1 Kilometer Polygon Map

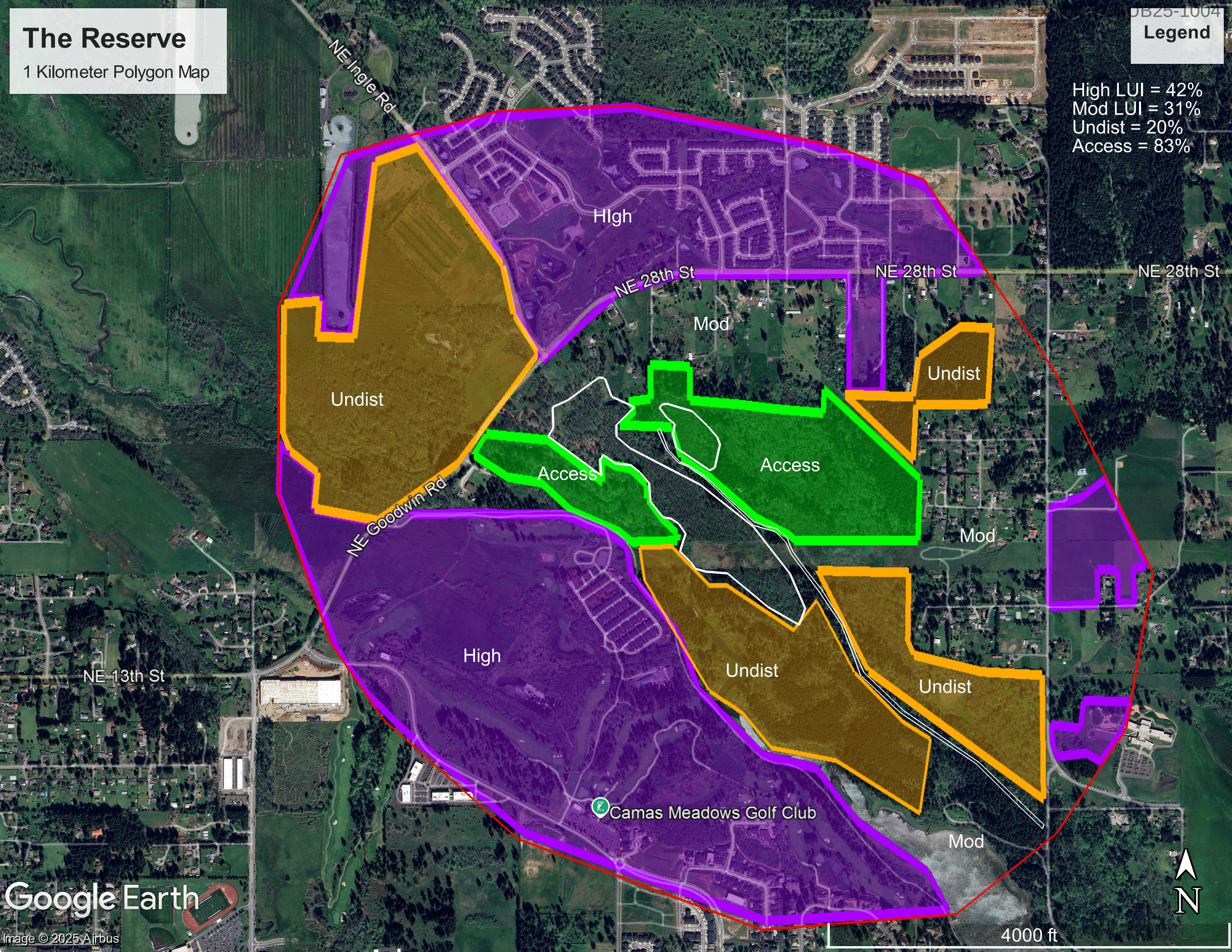
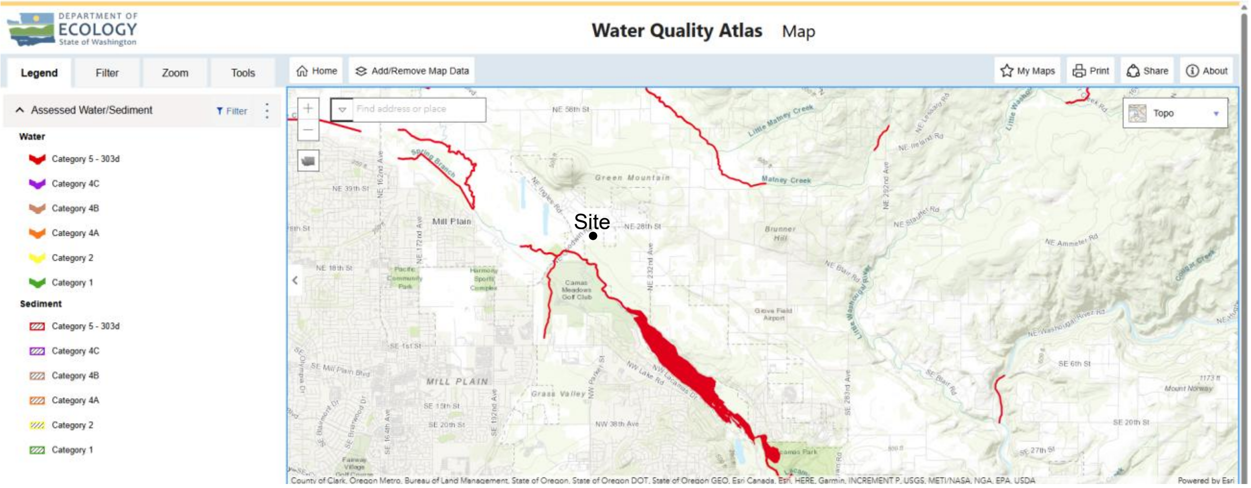
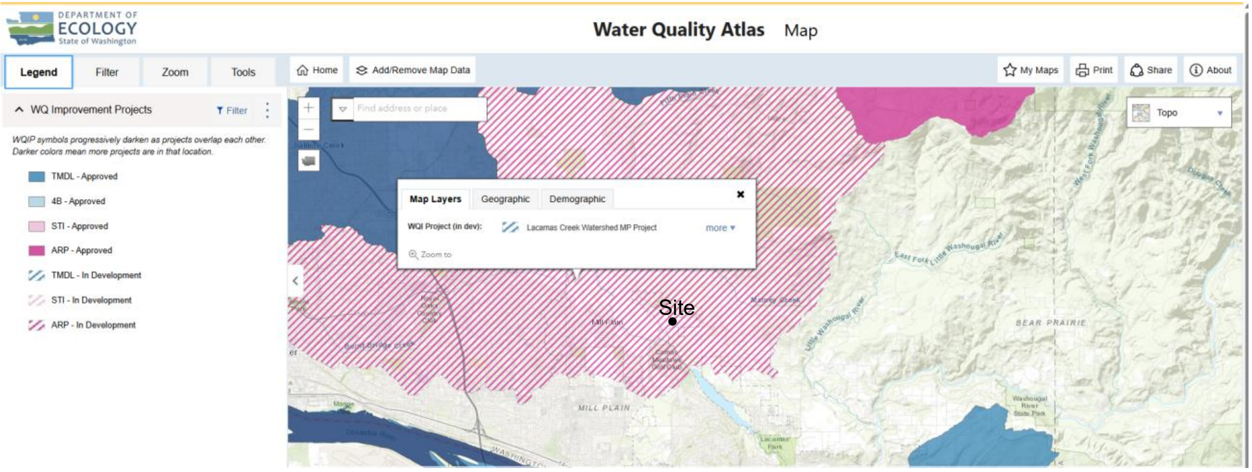


Exhibit 21 SUB25-1004

The Reserve at Green Mt.
WRF Figure 3



↑Screen capture of map of 303(d) listed waters in basin (from Ecology website).



WQIP symbols progressively darken as projects overlap each other. Darker colors mean more projects are in that location.

WQI Project (in dev): Lacamas Creek Watershed MP Project

↑Screen capture of list of TMDLs for WRIA in which unit is found (from Ecology website).

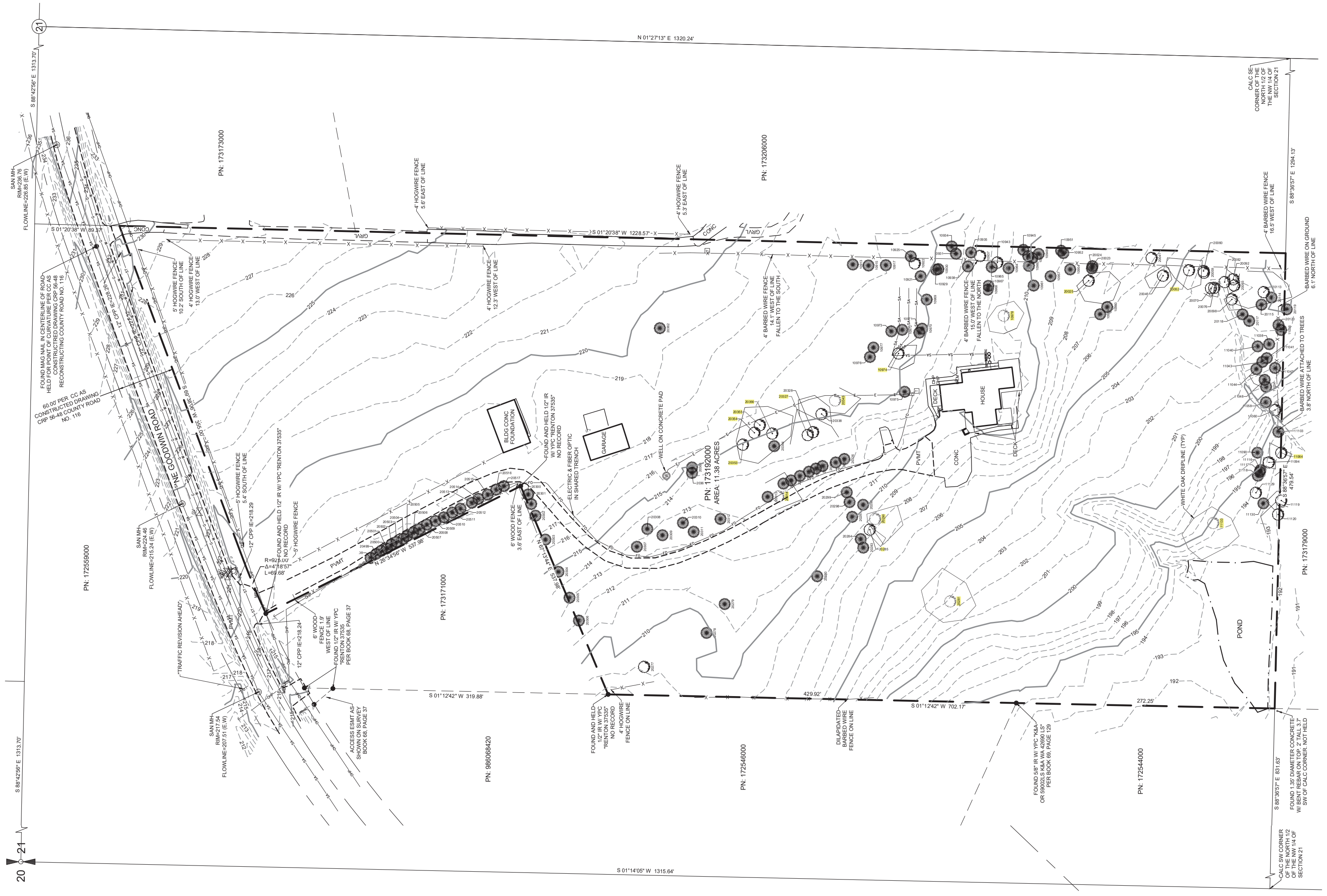
Appendix D

Tree Plan (Map & Table)

Exhibit 21 SUB25-1004

EXISTING CONDITIONS SURVEY

IN THE NW 1/4 OF THE SW 1/4
SECTION 21, T. 2 N., R. 3 E., W.M.
CITY OF CAMAS
CLARK COUNTY WASHINGTON
JOB NO.: 3927
DATA COLLECT: MARCH 2025
DRAWING DATE: 03-20-2025
SHEET 1 OF 1



LEGEND:

WV INDICATES WATER VALVE
INDICATES FIRE HYDRANT
WSP INDICATES WATER STAND PIPE
INDICATES WELL
INDICATES SANITARY SEWER MANHOLE
SEPTIC INDICATES SEPTIC SYSTEM LID
N,NE INDICATES POWER POLE WITH DIRECTION OF OVERHEAD LINES
INDICATES GUY ANCHOR
EM INDICATES ELECTRIC METER
T INDICATES TRANSFORMER
HP INDICATES HEAT PUMP
GV INDICATES GAS VALVE
INDICATES SIGN
INDICATES WETLAND FLAG
12"FIR INDICATES EVERGREEN TREE WITH TRUNK DIAMETER AND TYPE
12"MAPLE INDICATES DECIDUOUS TREE WITH TRUNK DIAMETER AND TYPE
F INDICATES FIBER OPTIC PEDESTAL
MB INDICATES MAIL BOX

INDICATES BOUNDARY
INDICATES EDGE OF ASPHALT
INDICATES EDGE OF CONCRETE
INDICATES EDGE OF GRAVEL
INDICATES 5 FOOT INTERVAL CONTOUR
INDICATES 1 FOOT INTERVAL CONTOUR
X X INDICATES FENCE LINE
INDICATES EDGE OF WATER
INDICATES PAINT STRIPE
OHP INDICATES OVER HEAD POWER
INDICATES TREE DRIP LINE

HORIZONTAL DATUM:

NAD 83 (2011)
WASHINGTON STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, U.S SURVEY FEET. BASED ON REAL TIME KINEMATIC CORRECTIONS FROM THE WASHINGTON STATE REFERENCE NETWORK.

VERTICAL DATUM:

NGVD29(47) CLARK COUNTY DATUM, DERIVED BY WSRN OBSERVATIONS, NAVD(88) TO NGVD 29(47)=-3.21'

NOTES:

1. BOUNDARIES WERE DRAWN PER PLAT, SURVEY RECORDS AND MONUMENTS FOUND. THIS IS NOT INTENDED TO BE A BOUNDARY SURVEY. NO PROPERTY CORNERS WERE SET IN THIS SURVEY.

2. NO WARRANTIES ARE MADE AS TO MATTERS OF UNWRITTEN TITLE, SUCH AS ADVERSE POSSESSION, ESTOPPEL, ACQUIESCENCE, ETC.

3. A PRIVATE UTILITY LOCATE WAS CALLED FOR ON 03-26-2025. THE UNDERGROUND UTILITIES AS SHOWN HEREON ARE AS MARKED AT THE TIME OF THIS SURVEY. UNDERGROUND UTILITY LOCATIONS SHOWN ARE APPROXIMATE ONLY. UNDERGROUND CONNECTIONS ARE SHOWN AS STRAIGHT LINES BETWEEN SURFACE LOCATIONS BUT MAY CONTAIN BENDS OR CURVES NOT SHOWN. SOME UNDERGROUND LOCATIONS HEREON MAY HAVE BEEN TAKEN FROM PUBLIC RECORDS. M.G.S. ASSUMES NO LIABILITY FOR THE ACCURACY OF PUBLIC RECORDS.

ADAM B. THOMPSON
21032302

60 30 0 60 90 120
SCALE 1 INCH = 60 FEET

PLS ENGINEERING
Engineering - Surveying - Planning
604 W. Evergreen Blvd., Vancouver, WA 98660
PH: (360) 944-6519 Fax: (360) 944-6539

Exhibit 21 SUB25-1004

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SHEET 1 OF 1

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	INDICATES 1 FOOT INTERVAL CONTOUR
X X	INDICATES FENCE LINE
	INDICATES EDGE OF WATER
	INDICATES PAINT STRIPE
OHP	INDICATES OVER HEAD POWER
	INDICATES TREE DRIP LINE

Point Table

Point #	Raw Description
10937	7"TRD
10938	9"FIR
10943	11"CHERRY
10944	25"FIR
10945	24"FIR
10948	14"FIR
10949	22"FIR
10951	19"FIR
10952	22"FIR
10954	29"FIR
10960	22"FIR
10961	29"FIR
10964	10"FIR
10965	10"FIR
10967	23"FIR
10968	29"FIR
10969	34"FIR
10970	30"FIR
10971	26"FIR
10972	26"FIR
10973	36"FIR
10975	28"FIR
10976	29"FIR
10977	13"FIR
10979	14"FIR
10980	18"FIR
11036	20"FIR
11038	15"FIR
11040	36"FIR
11041	23"FIR
11043	7"FIR
11044	20"FIR
11047	19"FIR
11054	40"FIR
11058	19"FIR
11090	29"FIR
11103	15"FIR
11116	21"FIR
11117	7"FIR
11118	24"FIR

Point Table

Point #	Raw Description	
11129	7"TRD	
11130	25"FIR	
20023	12"FIR	
20024	10"FIR	
20041	16"TRD	
20059	8"TRD	
20060	15"TRD	
20114	19"FIR	
20115	22"FIR	
20117	22"FIR	
20118	21"FIR	
20119	19"FIR	
20120	12"FIR	
10974	24"WHITE OAK	
10978	19"WHITE OAK X2 SHARED TRUNK	<20" DBH
11060	23"WHITE OAK	
11064	29"WHITE OAK	
11094	16"WHITE OAK	< 20" DBH
11119	18"WHITE OAK	<20" DBH
11120	23"WHITE OAK	
11133	43"WHITE OAK	
20025	24"WHITE OAK	
20045	24"WHITE OAK	
20052	26"WHITE OAK	
20070	11"WHITE OAK	<20" DBH
20076	11"WHITE OAK	<20" DBH
20082	18"WHITE OAK	<20" DBH
20092	10"WHITE OAK	<20" DBH
20093	11"WHITE OAK	<20" DBH
20098	14"WHITE OAK	<20" DBH
20113	29"WHITE OAK	
11048	8"WHITE PINE	

Point Table

Point #	Raw Description	
20301	14"FIR	
20303	18"FIR	
20304	17"FIR	
20305	15"FIR	
20277	7"TRD	
20278	39"FIR	
20279	33"FIR	
20280	37"FIR	
20281	36"WHITE OAK	
20283	27"FIR	
20284	22"FIR	
20290	25"WHITE OAK	
20296	27"FIR	
20297	24"FIR	
20298	18"FIR	
20299	26"FIR	
20300	18"FIR	
20306	15"FIR	
20307	32"FIR	
20308	26"FIR	
20309	22"FIR	
20310	23"FIR	
20311	17"FIR	
20312	22"FIR	
20313	23"FIR	
20314	12" 14" 14" 16"WHITE OAK SHARE TRUNK	
20319	12"FIR	
20320	8"FIR	
20321	18"FIR	
20322	19"FIR	
20323	8"FIR	
20324	9"FIR	
20325	28"FIR	
20326	27"FIR	
20327	21" 17"WHITE OAK SHARED TRUNK	
20328	9" 6"WHITE OAK SHARED TRUNK	<20" DBH
20285	13"WHITE OAK	<20" DBH
20302	17"FIR	<20" DBH
20338	19"WHITE OAK	<20" DBH
20343	22"WHITE OAK	

Point Table

Point #	Raw Description
20344	29"FIR
20353	21"WHITE OAK
20354	25"WHITE OAK
20355	22"WHITE OAK
20356	23"WHITE OAK
20362	20"FIR
20363	37"FIR
20364	19"FIR
20498	12"CEDAR
20499	10" 6"CEDAR
20500	9"CEDAR
20501	10"CEDAR
20502	10"CEDAR
20503	10"CEDAR
20504	10"CEDAR
20505	10"CEDAR
20506	12"CEDAR
20507	11"CEDAR
20508	12"CEDAR
20509	12"CEDAR
20510	12"CEDAR
20511	11"CEDAR
20512	15"CEDAR
20513	13"CEDAR
20514	14"CEDAR
20515	12" 6"CEDAR
20516	15"CEDAR
20517	16"CEDAR
10957	25"FIR
10913	25"FIR
10915	20"FIR
10917	22"FIR
10921	27"FIR
10922	13"TRD
10925	27"FIR
10929	35"FIR
10930	11"FIR
10931	24"FIR
10934	20"FIR
10935	28"FIR

Note: Tree survey reflects
16 jurisdictional Oregon white oak
present onsite (>20" DBH).

The project will retain all 16 Oregon white oak.

HORIZONTAL DATUM:

NAD 83 (2011)
WASHINGTON STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, U.S SURVEY FEET. BASED ON REAL TIME KINEMATIC CORRECTIONS FROM THE WASHINGTON STATE REFERENCE NETWORK.

VERTICAL DATUM:

NGVD29(47) CLARK COUNTY DATUM, DERIVED BY WSRN OBSERVATIONS, NAVD(88) TO NGVD 29(47)=-3.21'

NOTES:

1. BOUNDARIES WERE DRAWN PER PLAT, SURVEY RECORDS AND MONUMENTS FOUND. THIS IS NOT INTENDED TO BE A BOUNDARY SURVEY. NO PROPERTY CORNERS WERE SET IN THIS SURVEY.

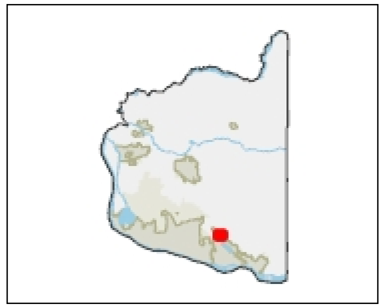
2. NO WARRANTIES ARE MADE AS TO MATTERS OF UNWRITTEN TITLE, SUCH AS ADVERSE POSSESSION, ESTOPPEL, ACQUIESCENCE, ETC.

3. A PRIVATE UTILITY LOCATE WAS CALLED FOR ON 03-26-2025. THE UNDERGROUND UTILITIES AS SHOWN HEREON ARE AS MARKED AT THE TIME OF THIS SURVEY. UNDERGROUND UTILITY LOCATIONS SHOWN ARE APPROXIMATE ONLY. UNDERGROUND CONNECTIONS ARE SHOWN AS STRAIGHT LINES BETWEEN SURFACE LOCATIONS BUT MAY CONTAIN BENDS OR CURVES NOT SHOWN. SOME UNDERGROUND LOCATIONS HEREON MAY HAVE BEEN TAKEN FROM PUBLIC RECORDS. M.G.S. ASSUMES NO LIABILITY FOR THE ACCURACY OF PUBLIC RECORDS.

ADAM B. THOMPSON
21032302

60 30 0 60 90 120
SCALE 1 INCH = 60 FEET

PLS ENGINEERING
Engineering - Surveying - Planning
604 W. Evergreen Blvd., Vancouver, WA 98660
PH: (360) 944-6519 Fax: (360) 944-6539



Legend

☐ Taxlots

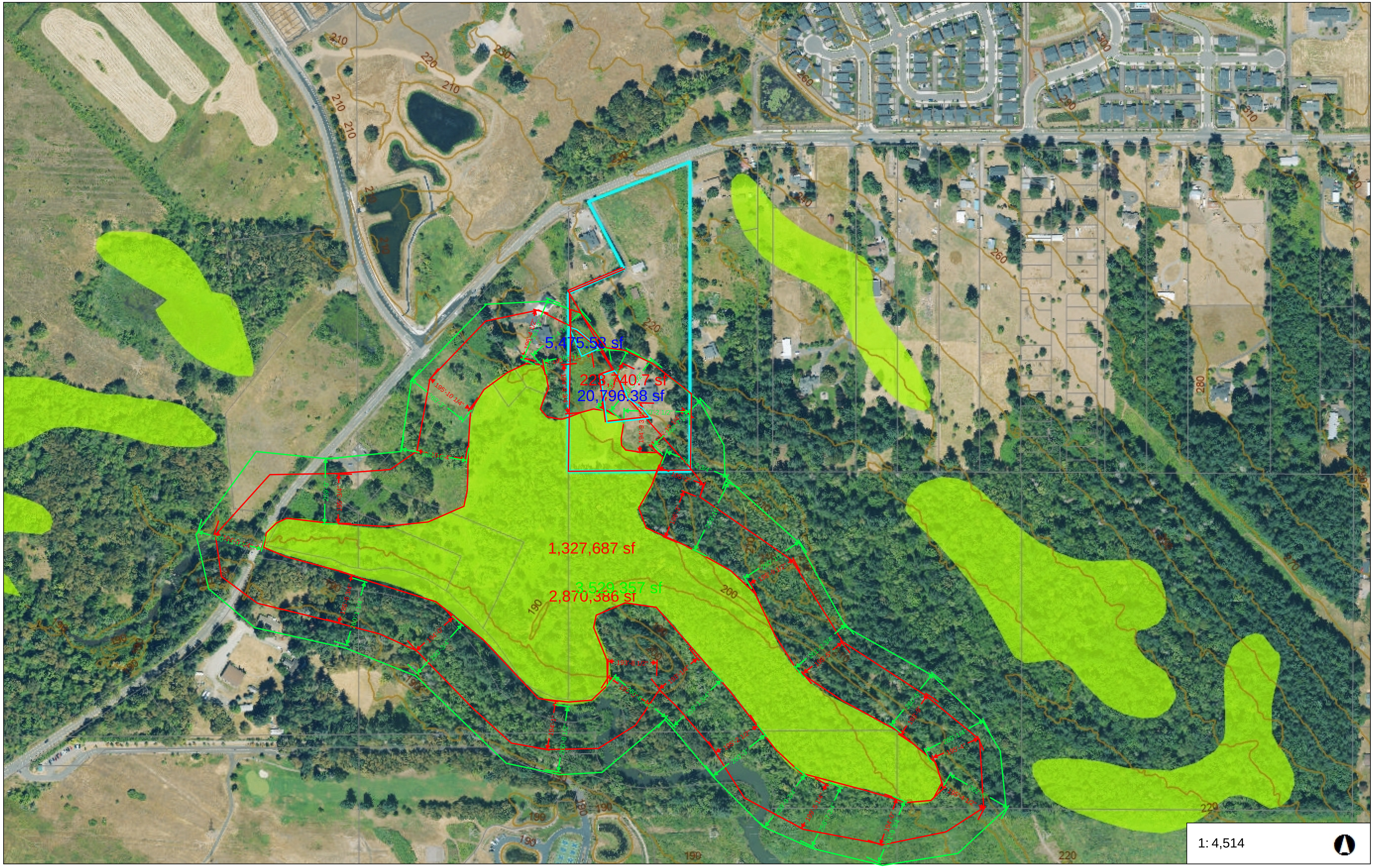
— Contours Lines - 2 ft

— Contour Lines - 10 ft

Notes:

0.1 0 0.07 0.1 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov



Legend

☐ Taxlots

— Contour Lines - 10 ft

🟩 NWI Wetland

Notes:

0.1 0 0.07 0.1 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov